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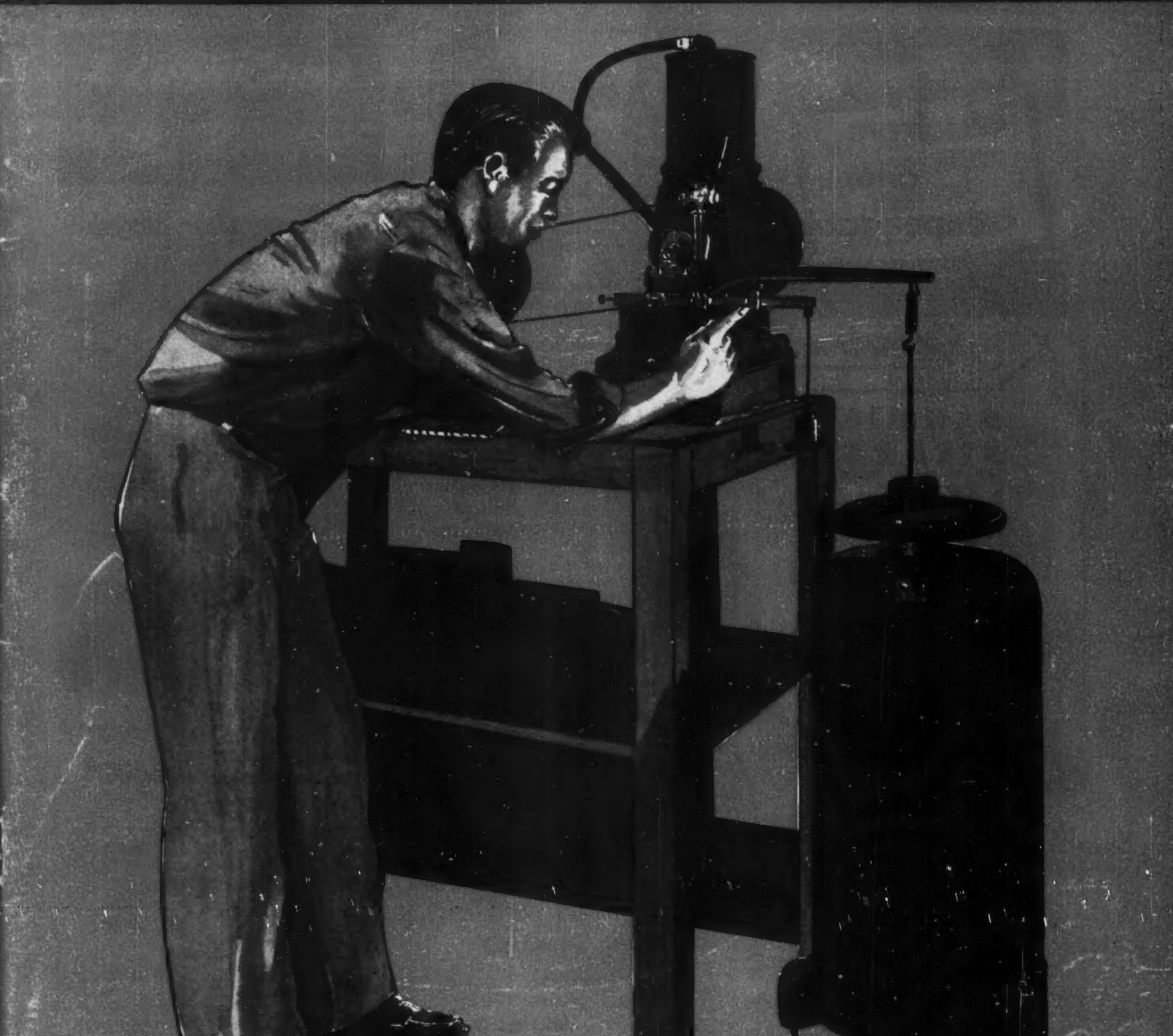
NLGI Spokesman

Journal of National Lubricating Grease Institute

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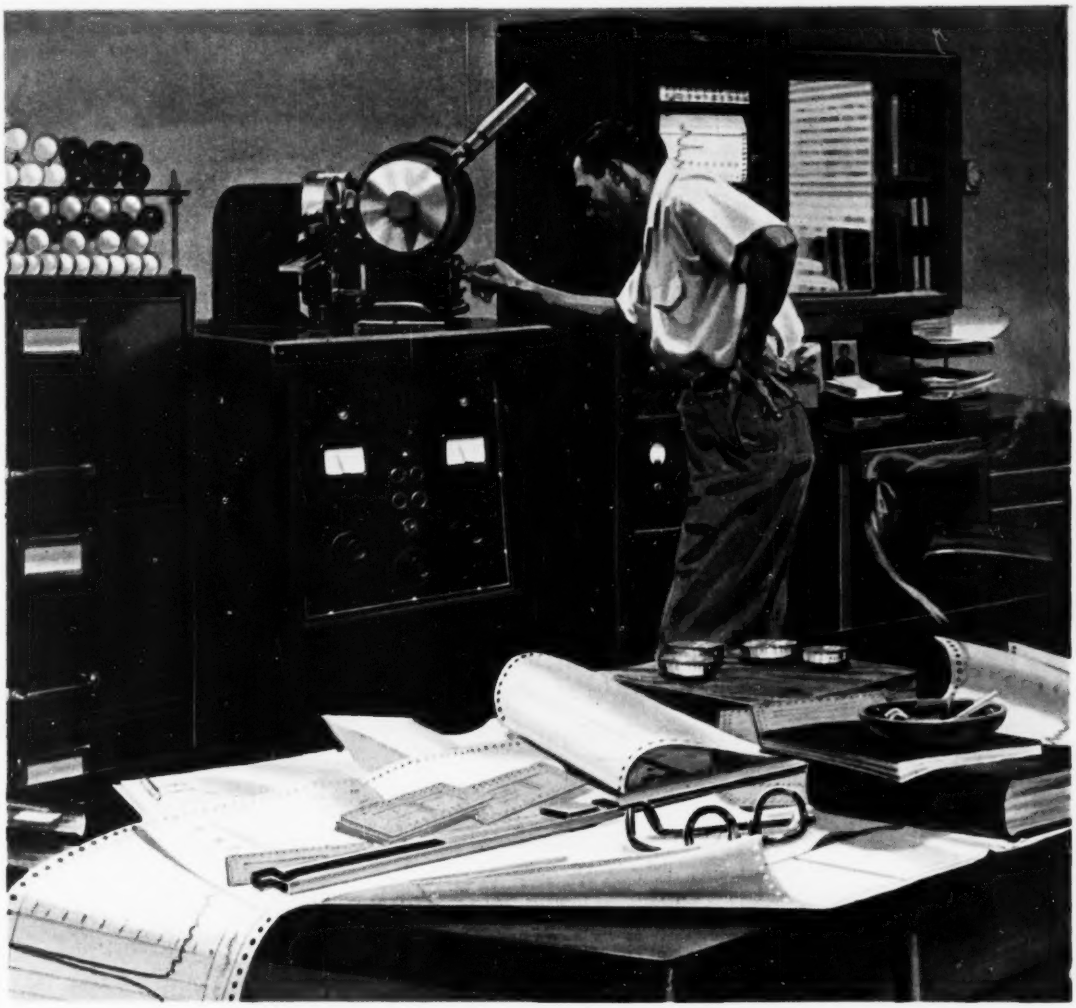

President's page

by G. A. OLSEN, President, N L G I

THE VALUE OF CHARACTER

Our two greatest ex-presidents and most outstanding citizens, George Washington and Abraham Lincoln, have one attribute in common, which is universally admired and associated with them, namely, their sterling character.

It is indeed heartening to recognize that the impact of their high character continues to contribute to the ideals of the nation as a whole.

Every American has reason to be thankful and proud that his country's first President and founding leader was a man of unimpeachable character, who established a standard which the majority of Americans are happy to follow, both in principle and practice.

Abraham Lincoln's high moral character and steadfast devotion to his high principles were unquestionably the major factors in reuniting a divided nation.

As we commemorate the birthdays of these two great Americans this month, it is encouraging to note that, even though today there is a prevalence of greed and selfishness in this busy world, time is still taken to honor these two great men and the qualities they personify, namely, integrity, loyalty, and steadfast devotion to their high principles.

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NLGI Spokesman

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ABOUT THE COVER

PICTURED ON THE COVER is a Timken Lubricant Tester, one of the instruments available in Witco Chemical Company's lubricants laboratory. This section of Witco's Technical Service Laboratories is devoted to development, testing and service work on E.P. (Extreme Pressure) lead naphthenates, lead oleates, sulfonates, and other additives for oils and greases. Development and service work on Witco's aluminum, lithium, calcium, and sodium soaps for grease manufacture also is conducted here.

The Timken Tester is one of the best-known devices for evaluating the effectiveness of thin films of lubricants under conditions of high pressure and temperature. These conditions are designed to simulate those encountered in hypoid gears and other heavy-loaded moving parts, although it is recognized that the machine does not exactly duplicate service conditions.

The picture shows the tester arranged for testing an oil, which is pumped from the heated reservoir at the top to flow continuously over the surfaces of the test block and ring. Greases are tested by continuous extrusion from a grease-gun device against the test surfaces. Examination and measurement of the scars produced on the test block indicates the resistance to breakdown of a thin film of the lubricant.

Lead soaps are not considered as primary Extreme Pressure additives, but are usually employed in combination with other additives for E.P. properties. In addition, these soaps are known for their excellent corrosion-preventive and detergent properties. They are incorporated in heavy duty motor oils, hypoid gear oils, friction-reducing engine additive oils, and in various greases. The overall lubricating properties of the oils and greases after incorporation of the lead soaps must be evaluated; hence careful studies of lead soaps in lubricants by such devices as the Timken Tester are made in Witco's laboratory.

To Mix—
Or Not To Mix

A STUDY OF WHEEL BEARING GREASE COMPATIBILITIES

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Do you manufacture lubricating grease? If so, you have undoubtedly had a product condemned for poor field performance, whereupon investigation showed the presence of a foreign soap base. Then you are interested in grease compatibilities.

Do you use lubricating grease? If so, you have undoubtedly considered a new grease for an old application. A worrisome issue was thus presented—what would happen were the old and new greases mixed?

Until very recently, one of our great automobile manufacturing companies phrased some instructions this way: "Front Wheel Bearings. If, on examination, the grease is found to be in good condition, do not remove it but add grease if necessary. If not in good condition, clean and repack . . . " Here again we are face-to-face with the problem: what if the grease already present and the one being added are not compatible?

This picture shows a dropping point cup being loaded.

With a few exceptions, the literature exhibits a magnificent silence on this subject. Not that the problem has not been recognized. Proudfoot's paper[1] presented here two years ago, described several mixtures of wheel bearing greases, showing the existence of a compatibility problem. An ASTM subcommittee[2] and a more limited NLGI joint committee[3] are currently active in this field. Verbal discussions at Annual Meetings and Technical Committee Meetings of the NLGI and the ASTM, as well as other organizations, have stated the problem and indicated the reason for insufficient attention in the literature is that the field is one of heroic dimensions. Testing could include every conceivable mixture such as greases made from each known thickener, in each of several types of formulation, being mixed in a multitude of proportions with greases made from all other thickeners. Tests applied to each mixture might properly include every procedure used for evaluating any grease lubricant made from either of the thickeners incorporated in that mixture. The addition of third components, and the action of used versus new grease as contaminant add immeasurably to the magnitude of the data to be gathered.

Any group attempting definitive research on compatibility would thus face a project with a beginning, and a middle, but no end. Any practical program on this subject must therefore be limited in scope.

Yet for several reasons, such a study and report seem pertinent:

1. Multi-purpose lubricants have been created from both old and new gelling bases. The degree of such novelty may be expected to increase in the future. Mixtures of some of these will inevitably be encountered. Guid-

ance is desired, and would be desirable.

2. A consumer who tests a particular pair of greases can reach only limited conclusions as to compatibility. But experience indicates that sweeping generalities are often so expressed. It seems preferable to gather more data of controlled scope, and to keep conclusions and generalizations within the boundaries of the data available.

3. A short survey of field experience with a pair of soda soap wheel bearing greases showed that not all makes of vehicles were involved in complaints; that those not encountered or showing up least frequently had been lubricated at the factory with soda soap grease; that the only recurrent complaints came in vehicles which had been lubricated at the factory with calcium soap (cup) greases. Among complaints referring to grease "turning fluid" or "soupy," or "running all over the brake bands," only a few samples of the used greases had been available. Admixed calcium soap nearly always showed up in what was supposed to be straight soda soap grease. The cases were not numerous nor specific enough for a quotable statistical analysis; yet a review of the whole file forced the speculation that the largest number of complaints as to wheel bearing grease seems attributable to contamination; and in a surprising proportion of cases the contaminant is grease of a different soap or thickening base.

In a project of limited scope, specific goals are essential. Hence it was decided to study enough mixtures to enable conclusions as to:

1. Whether, in general, mixtures are compatible or should be considered suspect.
2. Whether different greases made from one base are equally affected by the admixture of a second grease made from another base.
3. Whether one grease is affected to different degrees by the various types of grease mixed in as "contaminants."
4. Whether the proportion of contaminant so introduced makes a significant difference.

The choice of test method was obviously important, and received corresponding consideration. The possibility of using mechanical stability or dropping point led to a considerable accumulation of data to no avail. It seemed that a functional test must be used as a "no-go" gauge.

In mechanical testing, the use of a so-called "go-no-go" gauge is now common. However, a valuable functional test may serve as only half of such a gauge. A lubricant designed for a specific use may have a dozen or more required characteristics. The functional test may measure only one of these, in which case a failure on the test indicates that the product should not be used; the rating of "pass" means only that the product is worthy of further study. A pass is then not to be construed as assurance of successful performance.

The ASTM Wheel Bearing Grease Tester, used as a "no-go" gauge, was chosen as the device to be employed. This seems to limit the applicability of data then gathered. Nevertheless, the wheel bearing grease tester is of considerable interest in evaluating several types of grease lubricants: wheel bearing greases; multi-purpose automotive greases; multi-purpose industrial greases; and industrial roller bearing greases for use where speeds and pressures are moderate. The information so gathered is actually pertinent in a fairly wide area in the field of grease lubrication.

Illustrated at left is the loading of the inner bearing of the wheel bearing tester. Below is the same process applied to the hub of the ASTM tester.

The tester was described in 1945[4] and 1946[5], and in ASTM publications in 1948[6]. A number of changes in construction as well as details of operation, etc., have led to ASTM Method D-1263-53 T. The work here described was carried out on an older machine in which were incorporated all the required changes in construction. However, it seemed desirable to use a slightly off-standard procedure, which a great deal of laboratory data, in agreement with field experience, indicated as suitable. The procedure of D-1263-53 T was followed, with these exceptions:

1. The ambient temperature range was raised 5°F.
2. The spindle was thus maintained at 225 ± 2.5°F.
3. Total elapsed time consisted of the time needed to bring the spindle to 225°F, plus ½ hour. This required 80 ± 10 minutes not 360 ± 5 min.
4. Interpretation of results varies from the simple leakage report required in the ASTM writeup.

It must be realized that the tester is not a device designed for precise control. (This fact is quite obvious when we realize that in order to hold the spindle at a constant temperature, the thermostat controls the oven or ambient temperature. A more precise design would have caused the thermostat to control the spindle, an auxiliary or limiting thermostat preventing excessive oven temperature.) Nevertheless, the average test run at 225°F should be somewhat more severe than the average test run at 220°F. However, only slight differences between tests run this way and the standard 6 hour run have been observed. The principal effects are well developed by the time the machine has reached the test temperature, and the time saving is apparent.

However, the deviation in interpretation requires serious consideration. In the original test procedure, many observed factors were reported besides leakage. They included slumping, puddling, roping, oil separation, and gelation. The accumulated experience of many laboratories with a number of greases over several years showed that divergence is too great. Only on the basis of a single measured value—leakage—was agreement attained. But the experience of any one laboratory with any one grease is a different story. On a given grease, which we may call X, run after run shows no more than a trace of slump, a trace of grease on the spindle, and a trace of grease in the collector ring. Then on one batch the grease slumps a little more, a bit more grease is left on the spindle, and we find 0.3 g. of leakage. Our experience shows that this batch now indicates weakness. If this batch is allowed to go into the field, a complaint is likely to show up later. Another grease, which we may call Z, normally—batch after batch—shows about 0.5 g. of leakage, and still performs beautifully. This amount of leakage, which sounds inconsequential, is normal for grease Z, but has proved undesirable in grease X.

We have thus found it necessary to define a normal pattern for each grease, and to interpret any deviation from this pattern as a positive indication of weakness. This mode of interpreting results would be quite difficult when any laboratory is testing a wide variety of greases, trying to pick the best. In our experience, such use of the tester has not proved feasible. But where any one laboratory tests consecutive batches of the same product, this technique is applicable, and falls within the "no-go" gauge definition of the scope of the tester.

This is how we have described test results. A given grease, without any second component, is tested. This establishes the normal. (In some cases, repeat runs were made to assure that we had no excessive lack of repeatability.) The greases so tested are presented in Table I. Each of the products is being or has been used as wheel bearing grease. The calcium greases shown are not generally recommended for wheel bearing lubrication, but are typical of two which have been applied at the factory in various makes of cars, and have thus been encountered in mixtures in the field.

Now a second grease is mixed in, the proportion being known. If a test run on the mixture shows no change and thus no indication of weakness, the mixture may be considered compatible as defined by this test. (See Table VIII as an indication that other tests might give different results.) However, many test runs demonstrate considerable change, indicating the development of weak-

Figure 1

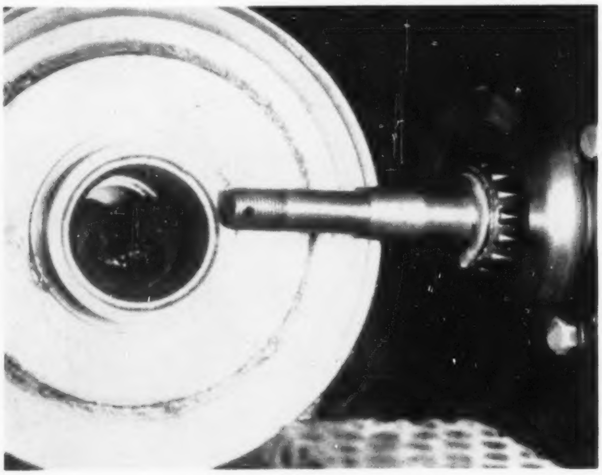

Figure 2

TABLE I

Characteristics of Greases Studied

IDENTIFICATION	A	B	C	D	E	F	G	H	I	K
Type Grease	Soda	Soda	Soda	Lithium	Lithium	Barium	Bentone	Silica	Calcium	Calcium
Soap Content, %	14	12.0	15.5	10.8	11.5	16.5	10.0	9.0	9.0	11.5
Water, %	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	0.2	0.3
Drop. Pt., °F	344	349	350	350	334	398	Over 400	Over 400	203	197
Oil Vis @ 210°F, SUS	80	80	90	60	80	54	80	150	95	39.5
ASTM Pen. 300 Strokes	236	247	225	298	284	286	266	274	320	374
ASTM Pen. 5000 Strokes	238	278	259	324	320	311	287	289	326	383
W. B. Run Results										
Leakage Total	None	None	None	None	None	1.5 g	None	None	Severe	Severe
Movement in Hub	None	Half-way	None	None	None	None	None	None	Flows Out	Flows Out
Amount Spindle Covered	None	½"	None	None	None	None	None	None	All	All

ness, which shows up in many cases without the incidence of severe leakage.

Some idea of the degree of change to be observed in these mixtures may best be illustrated here, in advance of a more systematic discussion. Figures 1 through 4 show nearly the full range. Figure 1 shows a typical good run. It actually pictures what was seen upon dismantling the machine after testing soda grease A. Many other tests—for example on lithium grease E, barium grease F, etc.—looked identical, so Figure 1 would be equally valid for any of these.

Lithium grease E—20%—was mixed with 80% soda grease A, and the mixture tested. Figure 2 illustrates what was found. Contrast this with Figure 1. Now grease has slumped down within the hub halfway. There is no grease on the spindle. But would you not interpret the mixture of Figure 2 as weaker than the pure grease of Figure 1? Yet leakage— none! (In all this work, leakage of up to 0.1 g was so reported.)

When 20% of calcium grease K was mixed into 80% soda grease A, and tested, Figure 3 was obtained. Again contrasted with Figure 1, grease has slumped more than halfway in the hub—almost out of the hub, and the spindle has grease on its back 1½ inches (about half of the spindle). Leakage—none!

Finally, a mixture of 50% barium grease F and 50% lithium grease E was tested and photographed, giving Figure 4. Both of the components, whose runs were not pictured since they looked exactly like Figure 1, showed firm structures. Here the spindle was completely covered by a thin, tough film of grease, which hung like a curtain from the spindle, a great deal dropping on the outside of the pulley when the tester was disassembled. Grease left in the hub flowed out onto the pan. Leakage—0.6 g. (Lithium grease E alone showed no leakage; barium grease F alone, 1.5 g., the mixture giving about an average value.) These two leakage values are within the repeatability of the test and must be interpreted as practically identical. But, without a shadow of doubt, the mixture, shown in Figure 4, is weaker than either component, whose runs would look like Figure 1.

It seems then that using the tester to observe changes in the pattern of the wheel bearing run, does disclose significant information regarding weakness developed due to the admixture of a second grease.

Grease mixtures were made by weighing appropriate amounts of each constituent, and mixing by hand in a pan, then 300 strokes in the ASTM Worker. Penetration and dropping point were taken—at first in the expectation that some correlation would be discovered,

Figure 3

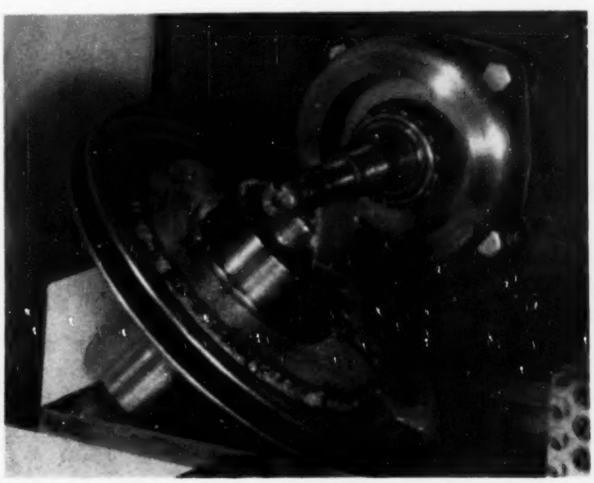

Figure 4

TABLE II

Tests on Soda Greases Mixed With Minor Amounts of Calcium Greases

IDENTIFICATION	A	A90 I10	A80 I20	A90 K10	A80 K20	B	B90 I10	C	C80 I20	C80 K20
Major Constituent, %	100 Na	90 Na	80 Na	90 Na	80 Na	100 Na	90 Na	100 Na	80 Na	80 Na
Minor Constituent, %	....	10 Ca	20 Ca	10 Ca	20 Ca	....	10 Ca	....	20 Ca	20 Ca
Drop. Pt., °F	344	321	326	318	320	349	319	350	333	328
ASTM Pen. 300 Strokes	236	246	266	250	275	247	267	225	252	255
ASTM Pen. 5000 Strokes	238	281	286	283	310	278	290	259	289	287
W. B. Run Results										
Leakage Total	None	None	None	None	None	None	2.0 g.	None	None	None
Movement in Hub	None	None	Half-way	None	Almost Out	Half-way	Flows Out	None	¼"	Half-way
Amount Spindle Covered	None	None	None	None	1½"	½"	1½"	None	None	¼"

TABLE III

Tests on Other Soda Grease Mixtures

IDENTIFICATION	A90 D10	A90 E10	A80 E20	A80 F20	A80 G20	A90 H10	A80 H20	A50 H50
Major Constituent, %	90 Na	90 Na	80 Na	80 Na	80 Na	90 Na	80 Na	50 Na
Minor Constituent, %	10 Li	10 Li	20 Li	20 Ba	20 Ben	10 Si	20 Si	50 Si
Drop. Pt. °F	332	340	315	345	367	348	348	397
ASTM Pen. 300 Strokes	235	232	244	243	236	242	249	262
ASTM Pen. 5000 Strokes	278	278	281	281	260	288	288	301
W. B. Results								
Leakage Total	None	None	None	0.2 g	None	None	None	None
Movement in Hub	⅛"	1/16"	Half-way	Almost Out	None	None	None	None
Amount Spindle Covered	None	None	None	¼"	None	None	None	None

and then as an assurance that any change in observed results on the tester was not due to a drastic change in penetration or dropping point. After considerable accumulation of data indicated no correlation, these values were omitted on some of the later mixtures.

It seemed vital, when starting to work with mixtures, to determine whether we may generalize broadly, or narrowly, or not at all. Three soda soap wheel bearing greases called A, B, and C, and two calcium greases identified as I and K, were thus chosen. Table II presents the resultant data.

From Table II we may formulate certain generalizations. Soda grease A gives a normal wheel bearing run. 10% of calcium grease I added to this soda grease shows no effect. 20% of calcium grease I added to this soda grease starts to develop weakness. From this we conclude that:

1. If enough calcium grease is added to a good soda soap wheel bearing grease, the performance of that grease deteriorates.

When Soda grease A is mixed with 10% of calcium grease —either I or K—little effect is seen. However, when the proportion of calcium grease is increased to 20%, K is found to have more effect than A. We thus conclude that:

2. Different calcium greases vary in the measure of this effect.

Soda grease B, weaker to start with than A or C, is apparently much more affected when 10% of calcium grease is mixed in. The conclusion:

3. Different soda greases are affected in varying degrees.

Using soda grease A as a base, other types of grease were worked in. The general, though not unvarying procedure, was to mix in 10% of the second component. If this showed little effect, a mixture in the proportions of 80% to 20% was tried. In a few cases, 50-50 mixtures were tested. Table III summarizes the results.

Again certain points of interest must be emphasized. 10% of lithium grease added to soda grease had only a little effect. Raising the proportion to 20% of lithium grease pointed up the deterioration in behavior. 20% of barium grease gave a similar pattern. Thus:

4. If enough lithium or barium grease is mixed with a soda soap wheel bearing grease, the performance of that grease deteriorates.
5. When soda soap wheel bearing grease is mixed with minor proportions of Bentone grease, performance is not affected.
6. When soda soap wheel bearing grease is mixed with silica aerogel grease in almost any proportion, performance is not affected.

Since lithium greases have achieved a considerable measure of popularity, two such products were investigated in various mixtures. Results are presented in Table IV.

In general, though both lithium greases D and E gave good runs, grease E was more sensitive to contaminants. We find this true with 10% soda grease A, 10% barium grease F, and 20% calcium grease I. Thus, recognizing that only one formula of each minor constituent was

TABLE IV

Tests on Lithium Greases

IDENTIFICATION	D	D90 A10	D90 I10	D80 I20	E	E90 A10	E90 F10	E90 G10	E90 H10	E90 I10	E90 I20
Major Constituent, %	100 Li	90 Li	90 Li	80 Li	100 Li	90 Li	90 Li	90 Li	90 Li	90 Li	80 Li
Minor Constituent, %	....	10 Na	10 Ca	20 Ca	....	10 Na	10 Ba	10 Ben	10 Si	10 Ca	20 Ca
Drop. Pt., °F	350	343	345	332	334	....	....	....	....	335	320
ASTM Pen. 300 Strokes	298	293	291	313	284	....	....	....	....	282	279
ASTM Pen. 5000 Strokes	324	323	317	330	320	....	....	....	....	336	313
W. B. Run Results											
Leakage Total	None	5.0 g	None	1.0 g	None	8.4 g	6.7 g	0.2 g	0.5 g	None	1.0 g
Movement in Hub	None	Half-way	⅛″	¼″	None	Almost Out	Almost Out	Half-way	½″	None	Almost Out
Amount Spindle Covered	None	None	None	None	None	½″	None	None	None	None	None

TABLE V

Tests on Barium Greases

IDENTIFICATION	F	F90 A10	F90 D10	F50 E50	F90 G10	F90 H10	F90 I10	F80 I20
Major Constituent, %	100 Ba	90 Ba	90 Ba	50 Ba	90 Ba	90 Ba	90 Ba	80 Ba
Minor Constituent, %	....	10 Na	10 Li	50 Li	10 Ben	10 Si	10 Ca	20 Ca
Drop. Pt., °F	398	361	....	328	....	....	361	348
ASTM Pen. 300 Strokes	286	291	....	253	....	....	287	291
ASTM Pen. 5000 Strokes	311	301	....	286	....	....	361	348
W. B. Run Results								
Leakage Total	1.5 g	None	0.1 g	0.6 g	None	None	1.5 g	None
Movement in Hub	None	Half-way	Almost Out	Flows Out	Half-way	Almost Out	⅛″	¾″
Amount Spindle Covered	None	½″	¼″	Completely	None	¼″	None	1⅛″

TABLE VI

Tests on Bentone Greases

IDENTIFICATION	G	G90 A10	G80 A20	G90 E10	G90 F10	G80 F20	G50 H50	G90 I10
Major Constituent, %	100 Ben	90 Ben	80 Ben	90 Ben	90 Ben	80 Ben	50 Ben	90 Ben
Minor Constituent, %	....	10 Na	20 Na	10 Li	10 Ba	20 Ba	50 Si	10 Ca
Drop. Pt., °F	Over 400	Over 400	....	....	....	....	....	Over 400
ASTM Pen. 300 Strokes	266	274	....	....	....	....	....	288
ASTM Pen. 5000 Strokes	287	289	....	....	....	....	....	316
W. B. Run Results								
Leakage Total	None	None	None	0.6 g	None	None	None	14.7
Movement in Hub	None	None	None	⅛″	None	None	None	1″
Amount Spindle Covered	None	None	None	None	None	None	None	None

tested:

7. Lithium grease seems less sensitive to calcium grease, than to barium or soda grease.
8. Different formulae of lithium grease vary in their sensitivity to the admixture of a second grease.
9. A minor proportion of silica aerogel grease degrades lithium grease. However, the effect is only a little greater than that of calcium grease, and is considerably less than that of soda or barium grease.
10. A minor proportion of Bentone grease degrades lithium grease, the effect being a little greater than was found with silica grease.

Barium soap grease was chosen as the last soap-gelled wheel bearing grease to be studied. See Table V.

11. A minor proportion of admixed sodium or lithium grease lowers the rating of barium grease.
12. An increase in the proportion of lithium grease to 50-50 further weakens the gel structure.
13. Admixed calcium grease has somewhat less effect, a larger proportion being required to show a similar effect.
14. Bentone grease and silica aerogel grease are similar in effect to sodium or lithium grease.

Bentone grease was the next one chosen for study. Since dropping points were generally not obtainable by the ASTM procedure, such tests were stopped at 400°F. As nothing unusual was observed, "over 400" was reported. This may be seen in Table VI.

15. Admixed calcium grease, even in minor proportions, causes a striking increase in leakage of Bentone grease.
16. Lithium grease in small proportions shows some effect, though slight.

TABLE VII

Tests on Silica Aerogel Greases

IDENTIFICATION	H	H90 A10	H80 A20	H90 E10	H80 E20	H90 F10	H80 F20	H90 I10	H80 I20
Major Constituent, %	100 Si	90 Si	80 Si	90 Si	80 Si	90 Si	80 Si	90 Si	80 Si
Minor Constituent, %	....	10 Na	20 Na	10 Li	20 Li	10 Ba	20 Ba	10 Ca	20 Ca
Drop. Pt., °F	Over 400	Over 400	Over 400	....	....	....	....	Over 400	Over 400
ASTM Pen. 300 Strokes	274	282	271	....	....	....	....	294	306
ASTM Pen. 5000 Strokes	289	314	314	....	....	....	....	305	323
W. B. Run Results									
Leakage Total	None	1.8 g	0.4 g	None	None	None	None	1.8 g	1.4 g
Movement in Hub	None	None	None	None	None	None	None	None	⅛"
Amount Spindle Covered	None	None	None	None	None	None	None	½"	None

TABLE VIII

Effect of Change In Test Conditions

IDENTIFICATION	E	E90 I10	E	E90 I10
Major Constituent, %	100 Li	90 Li	100 Li	90 Li
Minor Constituent, %	....	10 Ca	....	10 Ca
Spindle Temp.	225	225	265	265
Ambient Temp.	237	237	285	282
W. B. Run Results				
Leakage Total	None	None	1.7	18.1 g
Movement in Hub	None	None	None	Almost Out
Amount Spindle Covered	None	None	None	None

17. Sodium grease and barium grease do not affect the performance of Bentone grease.
18. Silica aerogel grease, mixed 50-50 with Bentone grease, does not affect performance.

Silica aerogel grease, often called just "silica grease," and not to be confused with silicones, is another representative of the soapless greases. Here too, dropping points were found to be over 400°F. It is interesting that a mixture of 50% silica aerogel grease and 50% soda grease, reported in Table III, showed a dropping point of 397°F., although at lower proportions of soda grease dropping points remained "over 400." Table VII presents these results.

19. Silica aerogel grease is not greatly affected by minor proportions of any other grease tested. Barium or lithium grease shows no change; soda grease causes slight leakage; calcium grease shows about the same amount of leakage, and just begins to indicate transfer of grease to the spindle or movement in the hub. But all these effects are quite small.

One "angle" that has been by-passed is the effect of increasing severity of test conditions. In many cases the mixing in of a second grease did not affect performance. It is reasonable to speculate on the behavior of pure grease versus mixture when temperature and/or other conditions establish more severe requirements.

A lithium-calcium concoction taken from Table IV was chosen for study, without any motive other than curiosity. Results are presented in Table VIII. It must be observed that in form, this table is different from the others.

Both the lithium grease and the mixture chosen gave typical good runs (resembling Fig. 1) when the spindle was held at 225° F, requiring an ambient of 237°F. Raising the ambient some 45 or 50 degrees raised the spindle to 265°F. Now the unmixed lithium grease still gave a good run, although leakage was up from "none" to 1.7 g. But the mixed grease changed from the pattern of Fig. 1 to something more like Fig. 3, grease almost coming out of the hub. And leakage had increased to 10 times that of the unmixed grease. Although only one such test was made, a reasonable extension of these findings permits this conclusion:

20. An increase in test severity would show weaknesses in some mixture still acceptable under the conditions here studied.

This could go on and on—and on! But a large number and considerable variety of mixtures have already been covered, and some conclusions, fairly specific in nature, have been reached. Can broader conclusions, covering the four points raised near the start of this paper, also be drawn? It does seem that such statements are possible! But some cautions and limitations must be delineated, since there is much we may not conclude. The wrong interpretations are much more serious than the possible omission of a few valid comments.

1. In general, the mixing of wheel bearing greases of different types (made from different soaps or different gelling agents) is undesirable.
   a. This statement is accurate, since so many mixtures proved weaker than the original, uncontaminated, major constituent.
   b. Test data on a specific mixture is always more reliable than such a general statement. Thus, successful wheel bearing greases are being formulated from two or more bases in controlled proportions.

The danger lies in uncontrolled mixing in the field.

c. The fact that a mixture is worse than the starting grease does not assure poor performance of that mixture. It is better to visualize a decreased *ability to perform* (or "performability"). But where demand on the lubricant is not excessive, that ability may still be adequate.

d. All testing was done on wheel-bearing-type lubricating greases on a wheel bearing grease tester. Test conditions affect results, as has been demonstrated. A reasonable but unproved extension thus indicates the probability that such mixing should be avoided throughout the field of grease lubrication.

e. Whenever a new type of grease is to be added, or the type of grease already in a bearing is not known, all old grease must be thoroughly cleaned out before relubrication.

2. Different greases made from one base (as two soda greases, two lithium greases, etc.) are not affected to the same degree when a second grease is mixed in.

Thus, although all the greases here tested are being or have been used in wheel bearings, *no one grease may be considered identical in behavior with all greases made from that base.* All specific statements based on tests here presented must be qualified in this light.

3. Greases tested are affected differently by the different admixed greases.

4. Greases are affected differently as proportions of principal grease and of minor constituent are altered.

The utility of greases depends in part on their ability to lubricate, and in part on their structures, which are designed to meet projected or known performance requirements. These structures are the result of a careful blend of ingredients and process. The uncontrolled mixing in of another grease obviously changes both ingredients and process, with possible disastrous effects on structure. Whenever specific data to the contrary is lacking therefore, such added grease is best regarded in the same light as any contaminant.

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2. ASTM Technical Committee G, Section III, Subsection 5, N. W. Faust, Chairman.
3. The Joint Committee on Lubricating Greases for Railroad Antifriction Journal Bearings, Spokesman 17, No. 4, July 1953, p. 31.
4. Spokesman 9, No. 3, June 1945, pp. 1, 3.
5. E. W. Adams, Spokesman 9, No. 10, Jan. 1946, pp. 1-5. Also SAE Journal (Trans.) 54, No. 3, March 1946, pp. 133-7.
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A Modified Gear-Wear Tester

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Research Department
Standard Oil Company (Indiana)

ABSTRACT

The heavy loading used to accelerate the Navy gear-wear test strains the conventional mounting as well as the test gears, and results in mechanical difficulties and poor reproducibility. Ruggedness and precision are achieved in the new tester by overdesigning the mounting. For proper operation, the gear center distance must be between 0.004 and 0.014 inches over theoretical. The specified brass gear must be used to distinguish between diester and silicone greases. However, lead-free brass gears are available that give low wear with silicone oils.

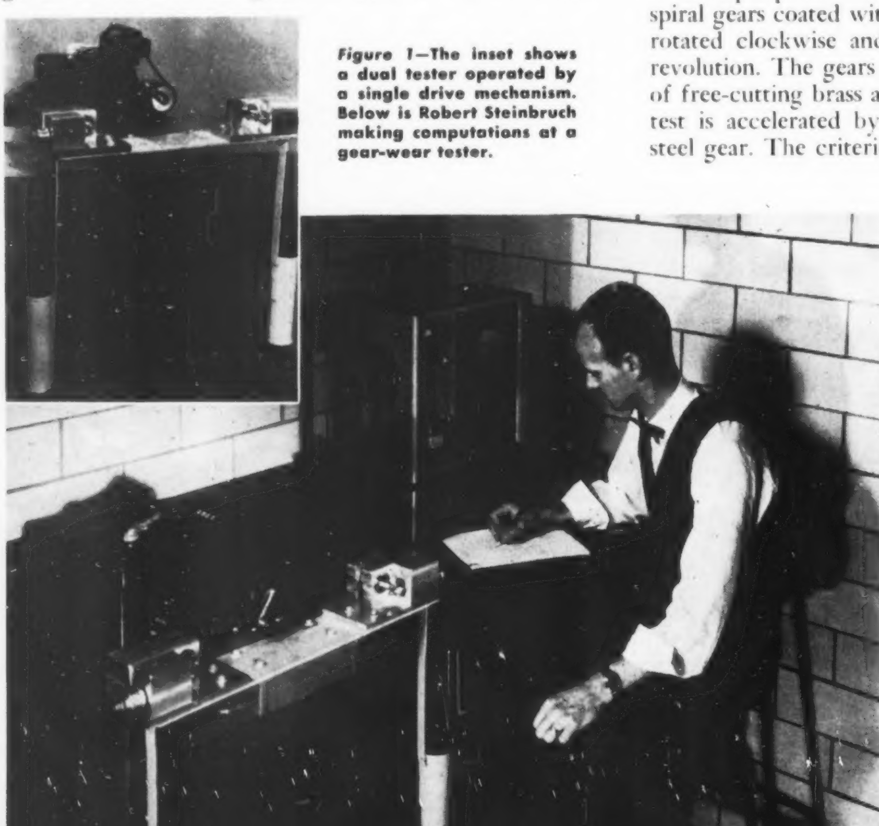


Figure 1—The inset shows a dual tester operated by a single drive mechanism. Below is Robert Steinbruch making computations at a gear-wear tester.

Introduction

One way to evaluate the antiwear properties of a lubricant is to study its behavior in a device built to simulate service use. Such a device is the gear-wear tester designed by the Department of the Navy.[1] This tester uses gears as test pieces and is particularly well suited to evaluating lubricants for gear mechanisms found in aircraft. A test using this apparatus with gears of specified composition is a requirement of some government specifications for lubricating greases.

Principal parts of the gear-wear tester are two mating spiral gears coated with the test lubricant and alternately rotated clockwise and counterclockwise for about one revolution. The gears are one-half inch in diameter, one of free-cutting brass and the other of stainless steel. The test is accelerated by heavily loading the shaft of the steel gear. The criterion for judging the lubricant is the weight loss of the brass gear after a specified number of cycles.

Several years ago, gear-wear testers patterned after the Navy design were built in laboratories throughout the country.[2] Repeated mechanical problems were encountered. Gear shafts bent and alignment of the gears was difficult to maintain. Reproducibility of test results was poor.

A modified tester that retained the principal and general features of the Navy design has therefore been built. Improvements consist of bigger shafts, sturdier gear mountings, and better provision for precise shaft alignment. Under these conditions, only the gears are overloaded. Figure 1 shows a dual tester operated by a single drive mechanism.

Design and Construction

The major improvement is in the construction of the shaft, which has been increased in diameter from ¼ to ½ inch. As shown in Figure 2, a hole in the end of each shaft accommodates the gear hub. A key pressed into this hole drives the gear. The slotted gear fits over the key and is held in place by a cap screw. The parts of the shaft assembly are fixed by collars and a locking nut, rather than by set screws and force fits.

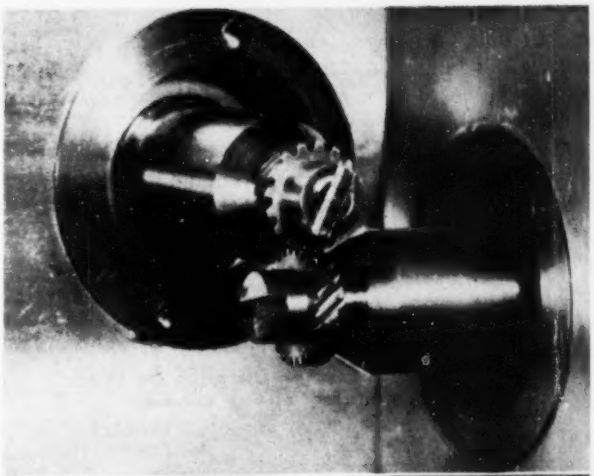
Each shaft is mounted in an aluminum pillow block, machined on the square, as shown in Figure 3, The shaft holes are bored on the square with the matching faces. This arrangement makes it easy to adjust the gear-center distance without disturbing the precise 90-degree alignment of the shafts. The distance is adjusted to 0.459 plus or minus 0.001 inches by shimming under the brass-gear block.

The center of each gear face is aligned on the center-line of the opposite gear by axial adjustment of the shafts. As shown in Figure 4, turning the bearing retainers positions the shaft assembly. Because the width of the gears varies only 0.002 inches, they are interchangeable and no further axial adjustment is needed.

An 1800-rpm synchronous motor coupled through a speed reducer operates the tester at 50 cycles per minute. A cycle counter attached to the output shaft of the speed reducer automatically stops the tester after any preset number of cycles.

Discussion

In developing the new tester, it was necessary to learn the effect of gear-center distance on gear wear. This



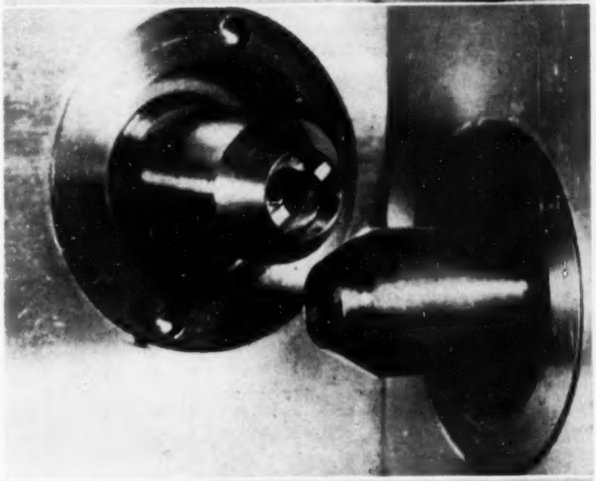


Figure 2—At upper right is pictured the construction of the shaft with slotted gears in place. Below, with gears removed from shaft.

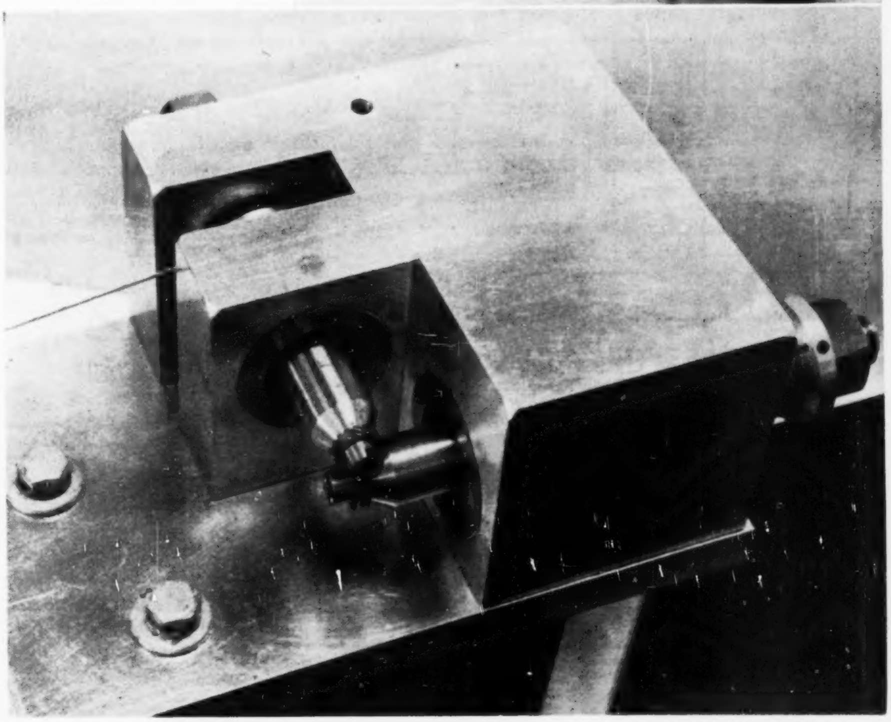


Figure 3—At right is shown the shaft mounted in an aluminum pillow block, machined on the square. The shaft holes are bored on the square with the matching faces.

problem arose because the theoretical distance of 0.4563 inches does not permit the gears to turn freely. Successive shimming under the brass-gear block showed that the gears bound at 0.4573 inches, but turned freely at 0.4582 inches.

The effect of three gear-center distances on test results was determined with a lithium-soap diester-oil grease meeting Specification MIL-G-3278.[3] The test procedure was as given in this specification. As shown in Table I and Figure 5, wear increases with gear-center distance, especially under the ten-pound load. The dashed portions of the curves show the probable behavior beyond experimental data. As the center distance is increased, wear increases and will become very large as the tooth contact surface becomes smaller. Unduly tight mounting also results in high wear. If the gears are mounted at a distance of from 0.458 to 0.460 inches, adequate repeatability will result because the curve is relatively flat throughout this range. The standard deviations shown in Table I indicate that repeatability becomes poorer as center distance increases. Better agreement between laboratories will therefore be obtained if center distances are as small as practicable.

When greases are tested against government specifications, exact composition for the brass gear is defined*. Analyses of gears obtained from two sources are compared to the specification requirements in Table II.

TABLE I

Effect of Gear-Center Distance on Wear

Seven test runs at each distance

Center Distance, Inches		*Weight Loss, mg* 5-lb Load 6000 cycles	10-lb Load 3000 cycles
0.4582	Arithmetic Average	2.4	2.8
	Standard Deviation	0.3	0.6
0.4610	Arithmetic Average	2.4	3.4
	Standard Deviation	0.6	1.0
0.4636	Arithmetic Average	2.8	3.9
	Standard Deviation	0.8	1.3

TABLE II

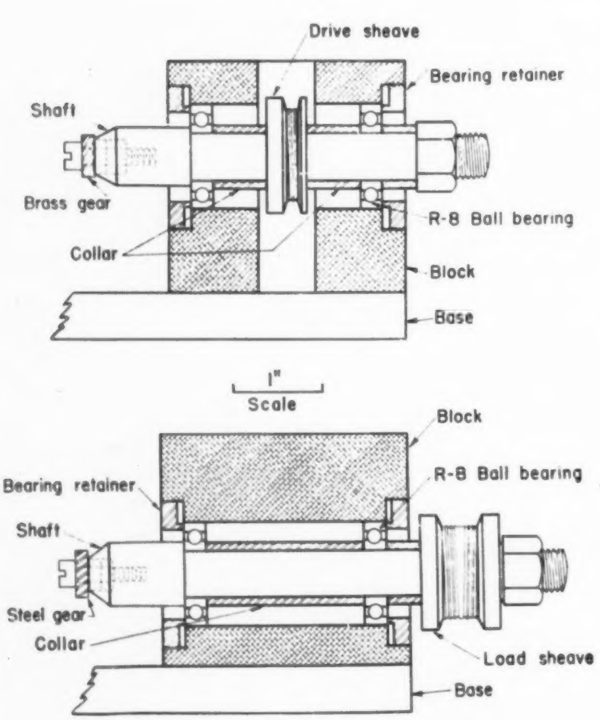
Composition of Brass Gear, Per Cent

Element	*Specification Requirement*	*Gear Source* *A*	*B*
Copper	60.0-63.0	62.52	58.89
Lead	2.5-3.75	3.64	0
Tin	0.3 Maximum	0	0.89
Iron	0.35 Maximum	0.15	0.15
Nickel	0.50 Maximum	0	0
Zinc	Remainder	33.69	40.07

Gears from source A meet the requirements; those from source B do not. Results obtained with gears from the two sources on a tester of the original design and on the modified tester are shown in Table III. The diester

FIGURE 4

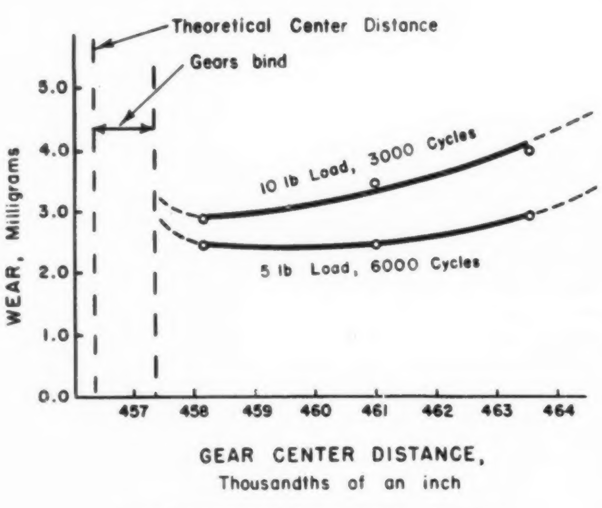
ASSEMBLY OF GEAR SHAFTS



Turning the bearing retainers positions the shaft assembly.

FIGURE 5

EFFECT OF GEAR CENTER DISTANCE ON WEAR

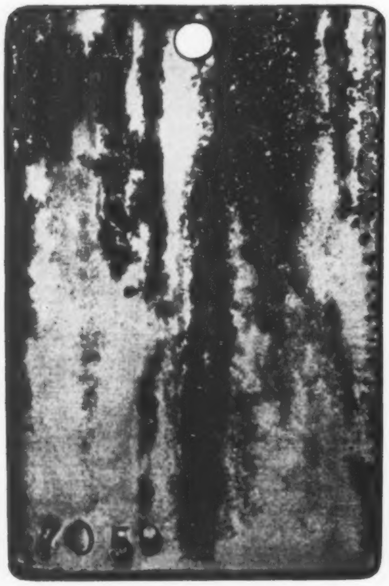


Wear increases with gear-center distance.

1,000-hour test of grease based on

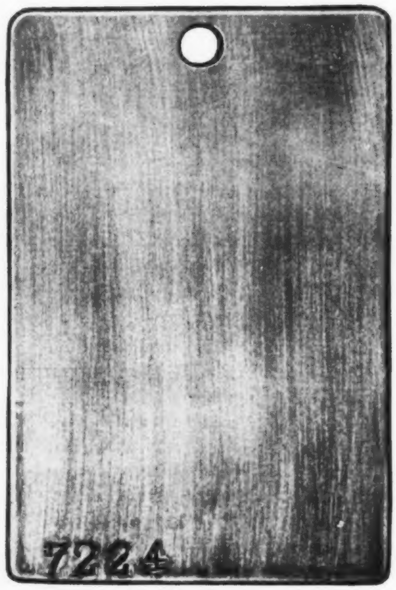
Metasap* Aluminum Stearate

defies rust, corrosion, and damage from salt spray



Rust marks show that grease "A" failed to protect this test panel.

Grease "B" did not prevent this serious rusting and pitting in 1,000 hours.



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grease gave little variation in wear on brass gears of different composition, but the silicone grease showed wide variations in wear. The gears from source B do not meet one purpose of the test—to distinguish clearly between diester and silicone greases. The importance of using only gears that meet the specification is apparent.

TABLE III

Effect of Gear Composition on Test Results

		Weight Loss, mg	
		5-lb Load	10-lb Load
Gear Source	Tester	6000 cycles	3000 cycles
	Diester grease		
A	Original	0.4	0.9
B		0.5	1.2
A	Modified	0.4	1.0
B		—	—
	Silicone grease		
A	Original	5.0	*
B		1.2	1.6
A	Modified	†	—
B		1.4	2.2

*Teeth stripped at 1700 cycles

†Teeth stripped at 3100 cycles

There is a corollary to the use of gears that distinguish between diester and silicone lubricants. The lead-free gears suffer wear that is acceptable in terms of the specification, even when silicone oil is used. Therefore, for practical applications that demand silicone lubricants because of temperature range, it appears advisable to reconsider selection of gear composition.

The modified gear-wear tester minimizes mechanical problems previously encountered. It affords a sensitive means of evaluating antiwear characteristics of greases for brass-on-steel applications. Because more reproducible results are anticipated, the tester may be worthy of standarization by some cooperative group.

*Brass gear must meet the requirement of Federal Specification QQ-B-611, Composition B.

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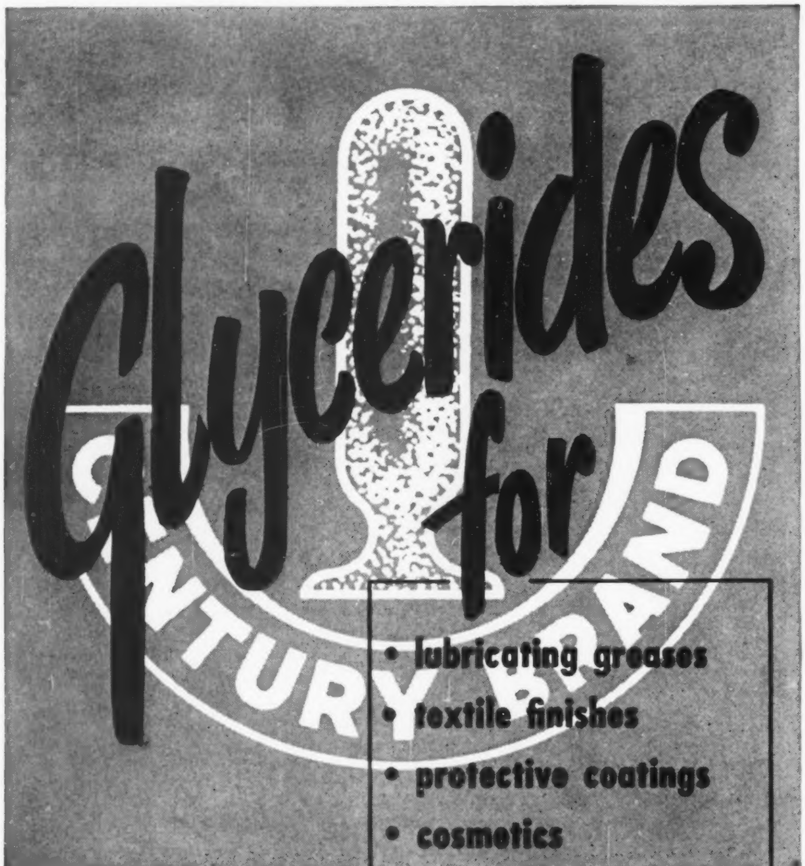
2. Ninos, N. J., "Evaluation of the Anti-wear Properties of Gear Greases," The Institute Spokesman, 15, No. 3 pp. 8-27. (1951).

3. Military Specification MIL-G-3278, "Grease; Aircraft and Instruments (for Low and High Temperatures)," Washington 25, D.C., Bureau of Supplies and Accounts, Navy Department, August 25, 1950.



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A NLGI Active Member Sends Greetings

HERMANN P. W. WANNER Sends an Album of Snapshots He Took During a Recent Week-End in the Bernese Oberland

Reproduced here are photographs and explanations as they appeared in an album Mr. Wanner sent the NLGI office.

Above left—reproduced full size is the photographer's business card that was clipped to the picture album. Explanations of all pictures were written by him.

Active Member Wanner is one of eight located outside the United States.

Top and bottom—Some peaks of the Bernese Alps.

A nice spot for a picnic-lunch.

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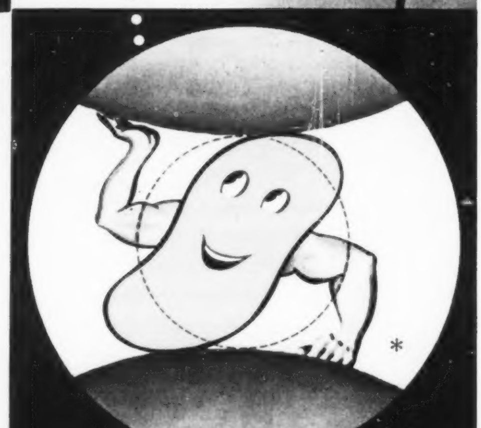


Patents and Developments

Greases Resistant to Water and Hydrocarbons

A water-resistant grease, which will not leave either a hard or soft residue when the lubricating portion of the grease is lost, is claimed in U. S. Patent 2,652,361 issued to Shell Development Company. The chief advantages of the composition comprise the essentially gasoline—and water—resistant character of the entire combination while, at the same time, the gelling agent tends to be powdery or is washed away to a large extent during the use in the transmission (by pipe line, for example) of gasoline or water, thus leaving a film of the mixture of lubricants on the pipe connections and avoiding plugging of the lines or erosion of connection parts such as felt washers, etc.

The essential ingredients of these greases include two miscible fluids, a water soluble polyoxyalkylene derivative and a partial ester (in weight ratio of 2:5 to 4:5) gelled with an inorganic colloid, such as silica gel.

The normally liquid partial ester of a water-soluble polyhydric alcohol, in which the alcohol has 2-10 carbon atoms, and the esterifying acid is a higher carboxylic acid having at least 10 carbon atoms, is exemplified by glycerol monoricinoleate, glycol mono (12-hydroxystearate), etc.

The other fluid component, the water-soluble polyoxyalkylene fluid not only should be soluble in water but should be also miscible with the partial ester component, and should have a volatility comparable to that of a medium viscosity lubricating oil. It should be insoluble in gasoline. An example is a Ucon fluid, such as one containing 2-10 carbon atoms per unit, with a molecular weight of 350-1200. The inorganic gelling component may vary in the range of 5-25% by weight of the grease.

The best results are claimed to be obtained when the polyoxyalkylene fluid constitutes 25-40% by weight of the grease, and the partial ester, 35-55%. Oxidation and corrosion characteristics are improved by inclusion of a combination of an aromatic amine and a higher fatty acid salt of a substituted oxazoline, such as those disclosed in U. S. Patent 2,402,791. Other additives include a hydrophobic cationic surfactant, an alkanolamine soap (for improved storage properties), synergistic inhibitor combinations, etc.

Another gasoline—and water-resistant grease is claimed in the Shell Development Company patent, 2,652,363. In this case, a hydroxyalkylamine soap, such as triethanolamine ricinoleate is used as the gelling agent in an amount of 20-50%. The base fluid is a polyoxyalkylene such as 50HB100 Ucon fluid, together with a partial ester like pentaerythritol monoricinoleate or glyceryl monoricinoleate in a ratio of 2:5 to 4:5.

Greases Resistant to Age-Hardening

It is well known that oxidation has a profound deteriorating effect on lubricating greases. The production of an oxidation-resistant grease having other superior properties with respect to shear-resistance, bleeding, and the like, is claimed in another patent (2,652,362) issued to Shell Development Company.

The invention involves the addition to the gel-oil ingredients, of two, and preferably three, particular types of additives in amounts much less than that of the gelling agent, which combination produces a synergistic effect giving the highly desired properties. The two main additives are (1) a high molecular weight naphthyl amine, and (2) a reaction product of a phosphorus sulfide with a dicyclic terpene. The third ingredient (3) for improving oxidation and corrosion resistance, is a metal salt of carbonic acid or its analogs.

Examples of the amine include phenyl alpha naphthylamine, benzyl phenyl napthylamine, diphenyl naphthylamine, etc.

The reaction product preferably is prepared by reacting one mol of a phosphorus sulfide (P_2S_5) with 4 mols of dicyclic terpene such as dipentene or terpinolene.

Examples of the third component include the calcium salts of dibutyl dithiocarbamic acid, zinc salt of N-Ethyl-N-phenyl monothiocarbamic acid, nickel salt of di (amyl piperidyl) dithiocarbamic acid, etc., which are used in amounts of 0.1-1%. The amine is added in an amount of about 0.5%, while the reaction product comprises about 1% by weight of the total grease.

Greases for High Temperature Operation

Greases made from normal soap-forming ingredients exhibit phase changes with increasing temperature, which makes them unsuitable for use on bearings operating at elevated temperatures. The Ricketts patent 2,182,137 proposed to overcome the disadvantages of such greases by using certain salts of aromatic acids, such as sodium benzoate, which apparently form complexes with normal soap-forming acids. But, such complex-salt greases had to be heated at 550-600°F. to produce a satisfactory grease structure, which operation involves fire hazards and other difficulties.

In U. S. Patent 2,652,364, issued to Shell Development Company, such hazards are claimed to be overcome by use of a special mineral oil having a viscosity of between 1250-11,000 SUS at 100°F., the oil containing less than 15% by weight of aromatic hydrocarbons, combined with a greater amount of a compatible synthetic high boiling liquid polyorganosiloxane having a viscosity within the lubricating oil range.

It was also noted that the addition of high molecular weight alcohols, particularly polycyclic alcohols, unexpectedly promotes high temperature operating life.

The siloxane such as dimethyl silicone fluid, comprises 55-95%, and the mineral oil 5-45%, of the liquid base mixture. The mixture is thickened by a soap predominating in sodium soaps of at least one carboxylic acid having 20 or more carbon atoms. The greases must contain an alkali metal salt of an organic carboxylic acid containing an aromatic ring, in the amount of 0.15-5%.

Among the alcohols which can be used are allocholesterol lanosterol, lanyl alcohol, ergosterol, etc., in an amount up to 5%.

The following composition was found to give a desirable grease by use of maximum cooking temperatures of 400-475°F.:

10% sodium beeswax soaps
3% sodium benzoate
3% cetyl alcohol

74% dimethyl silicone fluid
10% bright stock

Grease Concentrate Production

According to U. S. Patent 2,652,365 issued to Shell Development Company, extremely stable, non-bleeding greases may be prepared by first making a grease concentrate using a highly viscous oil and containing 10-50% of gelling agent, and then diluting the concentrate at any convenient time with a light oil of less than 300 SUS viscosity at 100°F, such as a spray oil, the amount of light oil being sufficient so that the final soap content based on the total composition varies from 4% to 15% by weight.

One novel feature of the process is that the concentrate, when prepared with a viscous oil, may be diluted in the cold or heated only slightly to say 80°-90°C prior to or while the light oil is being incorporated to produce the final grease product, which is claimed to result in a marked saving in fuel, and eliminates the need of transporting and handling large quantities of material and eliminates use of expensive equipment.

The gel phase is defined as a 2-phase system including solid crystalline soap and a liquid phase of either soap-oil jelly or pure oil. This gel phase forms as the grease is cooled from an elevated temperature of about 200°C at which it is in a jelly phase, to a temperature where recrystallization and consolidation of soap crystallites begin to occur (gel phase). Above 200°C, the soap-oil mixture may be regarded as being in a jelly phase in which soap and oil are in a homogeneous mass.

The process, as depicted diagrammatically in the Figure, involves adding into slurry tank 1 a pre-made soap or soap mixture and the highly viscous oil (of 500-2,000 SUS/100°F) and these are heated to around 120°C to drive out moisture and then led through pipe 4 and pump 6 into heating unit 9 where the grease is heated to 200°-250°C and worked until a homogeneous mixture is obtained. This hot grease concentrate containing 10-50% soap may be conducted into storage tank 26 and, at a convenient time, conducted via pump 20 into the final grease-forming kettle 13 where it may be admixed at room temperature or preferably heated to 90°C. with a light oil (50-300 SUS/100°F) which is introduced into kettle 13 through line 14.

It is preferred to heat-treat the concentrate prior to working it into the final grease in kettle or "Votator" 13.

News Items

Flow properties and mesomorphic behavior of anhydrous soaps at elevated temperatures—sodium stearate above 200°F.—Powell et al (Can. J. Chem. 9/53 p. 828).

Lubricating with moly disulfide—methods of application, design, etc.—Sonntag (Machine Design 7/53 p. 284).

Evaluating gear lubrication—gear failure, surface improvements, etc.—Borsoff et al (Machine Design 6/53 p. 304).

Molybdemum disulfide as a lubricant—dry use in railroad applications, etc. (Diesel Power 4/53 p. 90).

U. S. 2,642,995 (Josam Mfg. Co.)—Outlet for grease separators, etc.

U. S. 2,643,044 (Our Savior's Evangelical Lutheran Church)—Grease gun loading pail base for grease containers with cutter and interlock means for the containers.

U. S. 2,646,857 (Thomas)—Grease deflector.
U. S. 2,649,316 (Beezley)—Grease seal spacer.
U. S. 2,650,744 (Dirksen)—Grease gun.
U. S. 2,654,442 (Mathis)—Wire rope greaser.

PEOPLE in the Industry

Shell Chemical Promotes Downey and Fleer

A. W. Fleer

B. M. Downey

Two new head office posts have been set up by Shell Chemical Corporation to help meet demands resulting from the growing size and complexity of its manufacturing activities, it was announced by C. W. Humphreys, manufacturing vice president. One post will deal with current manufacturing activities and the other with future developments in plants, processes and products.

B. M. Downey, manager of the company's plant at Houston, Tex., has been appointed manager of manufacturing and A. W. Fleer, manufacturing operations manager, has been named manager of research, development and engineering. Each reports directly to Humphreys.

Reporting to Downey will be managers of plants at Houston; Denver, Colo.; Norco, La.; and Martinez, Dominguez and Torrance in California.

As manager of research, development and engineering Fleer will be in charge of the company's research, economic evaluation and process engineering activities as well as the engineering, design and construction of new plant facilities. The managers of the head office manufacturing development and manufacturing engineering departments will report to him.

Downey was born at Garret, Ind., and joined Shell in 1925 at Martinez as a laboratory helper. During the next 15 years he advanced through positions of increasing responsibility with Shell Oil, Shell Development and Shell Chemical. In 1941 he was placed in charge of the Dominguez plant of Shell Chemical Corporation and in 1946 was transferred to Houston as manager of the plant there.

Fleer was born at Quincy, Ill., and received his Ph.D. degree in chemical engineering from the University of Michigan at Ann Arbor. He started his Shell career as a technologist at St. Louis in 1935. In 1944 he became technical assistant to the president of Shell Development Company at San Francisco. He was appointed manager of manufacturing operations for Shell Chemical in 1952.

Philip E. Calo Company Increases Sales Staff

P. E. Calo, President, Philip E. Calo Company, Inc., announces that Ralph A. Palait has been appointed Sales Manager and Vice-President. He succeeds Julius A. Baggiani who resigned.

The present sales staff also includes Robert M. Minnick, James F. Soldat and will be augmented by the addition of Ralph T. Pedersen, a graduate of Bradley University and well experienced in sales work. Also Frank Kutchik, Jr., a graduate of Illinois Institute of Technology—chemical engineer. Both of these men are veterans of World War II.

Ehrlich Advances

Melville Ehrlich

American Lubricants Inc., has announced the election of H. R. Katzmann as president under a realignment of its executive set-up.

Mr. Katzmann succeeds Paul F. Fitzpatrick, who will continue as Chairman. Mr. Fitzpatrick will remain active in the company.

Melville Ehrlich has been elected vice president and a director. He has been with the company 11 years as director of research and will continue in that capacity.

John F. Moloney was appointed to the new position of director of sales in charge of wholesale and refinery accounts. He also was elected a director.

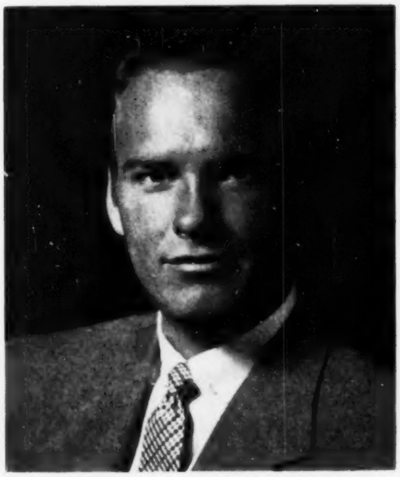
American Lubricants is a western New York distributor of home-heating oil for the Socony-Vacuum Oil Co. Inc. and also owns and operates the American Appliance Co., which provides warehouse and demonstration space for the Maytag Co., appliance manufacturer.

Shell Oil Appoints Publications Manager

Francis W. Steckmest, personnel director of the Shell Development Company research center at Emeryville, California, has been appointed manager of the employee publications department of Shell Oil Company in New York, it has been announced by F. H. Walker, vice-president.

Three Companies Announce Appointments of Key Personnel

Robert M. Chesney



W. S. Rheem, II

Dr. Edward F. Wagner

Robert M. Chesney has been promoted to vice president, manufacturing, of Deep Rock Oil Corporation, it has been announced by W. H. Garbade, president.

The new vice president, formerly manager of the company's Cushing, Okla., refinery will continue to live in that city.

In addition to overseeing refinery operations, he will assume new administrative responsibilities and will be in charge of Deep Rock's pipe line operations.

Operating headquarters of the pipe line department with J. H. Tubbs as manager, will continue to be located in Tulsa.

Chesney has been associated with the oil industry in various capacities since 1934 and has wide experience in refinery management, processing and petroleum chemistry. He received a B. S. degree in chemical engineering from the University of Delaware in 1932 and did graduate work at Temple university.

He launched his professional career in 1934 as a chemist with a large oil company. By 1949, Chesney had progressed to become superintendent of the company's large 70,000-barrel refinery in New Jersey. He joined Deep Rock in July of 1951 as manager of its Cushing refinery.

Chesney holds membership in a number of professional groups including American Petroleum Institute, Independent Petroleum Association of America, Western Petroleum Refiners Association, and American Management Association.

The Board of Directors of Rheem Manufacturing Co. has named William S. Rheem II as General Manager of the company in charge of all domestic manufacturing and marketing activities.

Rheem, who has been Assistant General Manager, will continue to make his headquarters at the company's South Gate plant in the Los Angeles area. His expanded responsibilities include operational direction of the company's Eastern, Western, and Aircraft Divisions, and supervision of all consumer and industrial activity, as well as military production, in the firm's 12 U. S. plants.

This appointment follows the company's announcement that C. V. Coons, a vice president and member of the board of directors, who has been serving as General Manager, was named Resident Director in New York City.

The new General Manager, who recently received his 15-year service pin with the company, has had experience in both production and administration.

Carl Weber Advances

Carl W. Weber has been appointed sales assistant in the chemical division of General Mills, Inc., Abner C. Hopkins, Jr., director of chemical sales, announces. He will be responsible for office operations of the division's sales department at Kankakee, Ill.

Weber joined General Mills in 1935 after receiving his bachelor of commercial science degree from Notre Dame in 1935.

Reassignment and extension of executive duties to integrate chemical operations in the area served by its Chicago plant have been announced by Witco Chemical Co., New York, N. Y.

Dr. Edward F. Wagner has been appointed manager at Chicago. He will continue serving also as director of the Technical Service Department. Dr. W. P. Pings will be assistant director of the plant laboratory. John V. Roach continues as plant superintendent.

Dr. Wagner received his doctorate from Illinois Institute of Technology. Prior to joining Witco in 1945, he served as chemical engineer with Standard Oil Co. of Ohio.

Deep Rock Advances Ralph B. Heuring

Ralph B. Heuring, district sales manager for Deep Rock Oil Corporation's Western district with headquarters in Des Moines, Ia., has been promoted to jobber sales manager, it has been announced by J. G. Campbell, vice president of marketing.

Heuring joined Deep Rock in 1924 in Omaha, Neb., where he remained in the sales field until 1942 when he was transferred to Des Moines as assistant sales manager for the Western district. When Deep Rock launched its jobberization program in 1951, Heuring was appointed sales manager of the Western district.

In this position, he headed all Deep Rock jobber sales operations in the state of Iowa and in parts of Illinois, Nebraska, and South Dakota.

Lubrication Chairman

Rudolph Cubicciotti

Congratulations are in order for NLGI Director Rudolph Cubicciotti who has recently been elected Chairman of the API Lubrication Committee. Mr. Cubicciotti has also served the NLGI for years and has been a member of the Board of Directors since 1949.

Recent announcement has also been made that he has been elected vice president of L. Sonneborn Sons, petroleum refiners and manufacturing chemists, with whom he has been associated in an executive capacity since 1943.

Mr. Cubicciotti was graduated from the University of California, Berkeley, 1925, in Chemical Engineering. Later he served seventeen years with Union Oil Company of California, starting as a control chemist and holding various posts in manufacturing and research. Later he entered Union Oils sales department as a technical assistant, becoming manager of lubricant and special products sales.

In addition to his considerable interest and contribution to NLGI affairs, he has also been active in the API Lubrication Committee since its formation.

Samuel Messer Becomes Chairman of Board

Quaker State Oil Refining Corp. announces the election of Mr. Samuel Messer, of Oil City, Pa. as chairman of the board. Mr. Messer has been with the company for more than a half-century, serving as vice-president, president and vice-chairman of the board.

Mr. Messer succeeds as board chairman Mr. Harry J. Crawford, who died November 3, 1953.

Dudley Fuller Joins The Franklin Institute

Dr. Nicol H. Smith, Director of the Institute's Laboratories for Research and Development, has announced the appointment of Dudley D. Fuller, widely known authority on lubrication, to the staff of the Mechanical Engineering Division of the Laboratories. As principal scientist in this division, Mr. Fuller will be in charge of the friction and lubrication section. This section is already active in friction and lubrication studies for industry and the government agencies.

Mr. Fuller will continue on the staff at Columbia University, where he is Associate Professor of Mechanical Engineering. In addition to teaching, he has directed research projects for some of the country's major industries.

F. G. Merckel Becomes Wallace & Tiernan President

Following the merger of Wallace & Tiernan Co. Inc. and Novadel-Agene Corporation to form Wallace & Tiernan Incorporated, it was announced that F. G. Merckel has been elected President, R. M. Jackson, Executive Vice President and Treasurer and G. D. Peet, Vice President in charge of Product Engineering and Development. The announcement was made by M. F. Tiernan, Chairman of the Board.

Mr. Merckel, an engineer by training has been with the Wallace & Tiernan group in various executive and sales capacities for nearly thirty-five years. For the past two years he has been president of W. C. Hardesty Co. Inc., a Wallace & Tiernan subsidiary. He is well know throughout all the fields of Wallace & Tiernan and Novadel activities, and brings to his new job a broad experience in management, sales, research and legal matters.

Socony-Vacuum Makes Klaerner Manager

Curtis M. Klaerner of Beaumont, Texas, has been appointed manager of the Buffalo, New York, refinery of the Socony-Vacuum Oil Company, Inc., effective Feb. 1.

Mr. Klaerner succeeds Richard B. Price, who has resigned to accept a position with Standard-Vacuum Oil Company.

Mr. Klaerner is now chief process engineer in the Technical Department of the Beaumont refinery of Magnolia Petroleum Company, a Socony-Vacuum affiliate.

A native of Fredericksburg, Texas, Mr. Klaerner was graduated from the University of Texas in 1942 with a degree in chemical engineering. Following graduation he joined Magnolia as a junior process engineer at the Beaumont refinery. Successive promotions in the refinery's Technical Department brought him to his present post, in which he has had charge of the department's Planning and Coordination Section.

Mr. Klaerner is a member of the American Chemical Society.

Detroit Hosts API Lubrication Committee Meeting

An outstanding program was featured in the February meeting of the Lubrication Committee of the Division of Marketing of the American Petroleum Institute, Chairman R. Cubicciotti, of L. Sonneborn Sons, Inc., announced.

The meeting was in the Sheraton-Cadillac Hotel in Detroit, February 15-17.

Speakers and their topics for the morning and afternoon general sessions were as follows:

"Preignition in the Modern Automobile," W. E. Bettoney, Assistant Manager of the Technical Section, Petroleum Chemicals Division, the Du Pont Company, Willmington, Del.; "The General Motors Training Centers," Paul F. McDonald, Service Section, General Motors Corp., Detroit.

"Valves and Valve Gear—the Gimmicks That Make a Successful Tank Train," Vincent Ayers, Assistant Chief Engineer, Valve Division, Eaton Manufacturing Co., Battle Creek, Mich.; "Automotive Power—Gas Turbines or Piston Engines?", M. M. Roensch, Research Supervisor, Ethyl Laboratories, Ferndale, Mich.

Dr. Neal Bowman, of the National Association of Manufacturers, New York, addressed the traditional dinner session. His topic was "Changes and Challenges."

C. W. Georgi, of Quaker State Oil Refining Corp., Buffalo, N. Y., was Chairman of the Program Committee, while H. F. Stringer, of Shell Oil Co., Detroit, was Chairman of the Detroit Committee on Arrangements.

API Appointments

A series of appointments to strengthen district office staffs and fill existing vacancies has been announced by H. B. Miller, Executive Director of the Oil Industry Information Committee of the American Petroleum Institute.

Seven men have been added to the field staffs, Miller reported. They are as follows:

Harry S. Phillips, formerly of Madison, Wis., assigned to the New York-New Jersey District Office in New York City. Phillips recently was separated from the U. S. Air Force as a First Lieutenant. He is assisting Frederick Grinnell and Robert A. Stromberg in operation of this office.

Robert T. Ross, of Haddonfield, N. J., to the Middle Atlantic District Office in Philadelphia, Pa. Ross had been News and Publicity Director for radio station WKDN in Camden, N. J. He has been assigned to help David McIlvaine and Bates D. McClean in this area.

Kenneth R. Gurley, of Atlanta, Ga., to the Southeastern District Office in Atlanta. Gurley formerly was Publicity Director for Time, Inc., in Atlanta. He is a replacement, and is associated with A. Dunson Dunaway in Atlanta.

Peter George Barkley, of Prairie Village, Kans., to the Missouri-Iowa-Nebraska District Office in Kansas City, Mo. Barkley had been with the Kansas City Star prior to his affiliation with the OIIC. Also a replacement, he is assisting Richard Joyce in this district.

John W. McDonald, of Evanston, Ill., to the Great Lakes District Office in Chicago. McDonald formerly was affiliated with Marshall Field & Co. He is assisting J. O. Hendrickson and Joseph W. Miller in the Great Lakes area.

Jack E. Robinson, of Dallas, Tex., to the Gulf-Southwest District Office in Dallas. A former employee of the East Texas Chamber of Commerce, he is working with William T. Lynde and Earl C. Grabhorn in his new position.

A. C. Rose, Jr., of Emporia, Kans., to the Kansas-Oklahoma home District Office in Tulsa. Rose previously was Director of Information and Publicity Director for Kansas State Teachers College. A replacement, he is assigned to help James Kemm in this area.

Logelin to Succeed Wilby

Arthur C. Wilby retired January 1 as vice-president of United States Steel Corporation in Chicago and was succeeded by Edward C. Logelin, it has been announced by Clifford F. Hood, president of the corporation.

Before becoming vice-president in 1946, Mr. Wilby for eight years was director of public relations for United States Steel in the Chicago district.

From 1943 to 1946, Mr. Logelin was principal assistant in New York to J. Carlisle MacDonald, assistant to chairman of the board in charge of public relations for the Corporation. Born and educated in Chicago, he began his business career with the WFL Drum Company as a stenographer in 1928 immediately following graduation from high school. He joined United States Steel in 1930 in the advertising department of Universal Atlas Cement Company.

In 1937, Mr. Logelin was appointed assistant to Mr. Wilby, then manager of public relations in the Chicago district for Carnegie-Illinois Steel Corporation. In 1941, he was named assistant director of public relations in the Chicago district.

Mr. Logelin is public relations chairman of the Illinois Manufacturers Association. He was 1953 public relations committee chairman for the Community Fund of Chicago and is a member of the National Community Fund Advisory Committee. He also has served as chairman of various committees of the Chicago Association of Commerce, Junior Achievement, and the Economic and Executive Clubs of Chicago and is past president and director of the Public Relations Clinic of Chicago. He is a member of the Union League Club of Chicago, South Shore Country Club, Chicago Press Club and Sigma Delta Chi.

A native of Waterloo, Iowa, where he graduated from high school and business college, Mr. Wilby joined United States Steel as a salesman for the Universal Atlas Cement Company. Earlier, he had been a clerk with the Illinois Central Railroad in Waterloo and later assistant superintendent of the Waterloo Cement Machinery Corporation. With Universal Atlas, he progressed through various positions until he became assistant to the president in 1917.

Dennery to NOPCO

Irene Dennery

NOPCO Chemical Company of Harrison, New Jersey, has announced the appointment of Miss Irene Dennery as Advertising and Sales Promotion Manager.

The new job is somewhat in the nature of a homecoming for Miss Dennery, who worked for NOPCO several years ago as assistant to the Vice-President.

Miss Dennery has recently been Advertising Manager for the Ajax Electric Company of Philadelphia, manufacturer of salt bath furnaces for the metal working industry. She has also served as Advertising Manager for "Seabrook Farms" the grower and packer of fruits and vegetables; and for Pennsalt, one of the oldest manufacturers of heavy chemicals in the country.

Miss Dennery is well known in advertising circles in Philadelphia and is one of the founders of the Industrial Marketers of New Jersey Chapter of the National Industrial Advertisers Association.

Dezmelyk Joins Foote R & D Staff

Eugene W. Dezmelyk recently joined the Research and Development department of Foote Mineral Company as a Mechanical Engineer. He received his B. S. Degree in M. E. at University of Pennsylvania and was employed by United Constructors and Engineers, Inc. and the Detroit Edison Company prior to joining Foote.

Nuodex Director

Edward D. Horgan

Nuodex Products Co., Inc., Elizabeth, N. J., makers of special-purpose chemicals for industry, announces the creation of a new Commercial Development department, with Edward D. Horgan as director.

The function of this department, according to Leo Roon, Nuodex president, is to devise and explore methods for the market introduction of new products and find new applications for established products.

Such directed management of new product programs, Roon states, is consistent with Nuodex' objective of growth through expansion into new fields.

New Personnel at Foote

Dr. Eunice P. Garrett recently succeeded Carolyn Donahey as Technical Librarian for the Research and Development Laboratories at Berwyn, Penna.

Dr. Garrett is a graduate of the University of Minnesota with a Doctor's Degree in Geology as well as an M.S. Degree in Library Science. She has been a librarian for a number of companies throughout the Philadelphia area and is a member of the Paleontological Society, Special Libraries Association and the Philadelphia Special Library Counsel.

Paul K. Lambert recently succeeded Frank Zelaney as Traffic Manager for Foote Mineral Company, Philadelphia.

Lambert, who obtained his B. A. degree in economics from Boston College in 1946 and his Master's degree in transportation from Wharton School in 1951, was with the Boston and Maine Railroad and General Refractories Company prior to joining Foote.

Willisch to Des Moines

A. W. "Gus" Willisch, sales representative for Deep Rock Oil Corporation in the Milwaukee area, has been promoted to district sales manager of the company's Western district with headquarters in Des Moines, it has been announced by J. G. Campbell, vice president of marketing.

A veteran employee with 30 years of sales experience with the company, Willisch joined Deep Rock in 1924 in the company's wholesale department in Chicago. He was named assistant manager of this department in 1931 and later became manager before shifting to Milwaukee as assistant division sales manager. In 1948, Willisch was promoted to division sales manager.

When Deep Rock launched its jobberization program a short time later and withdrew from all direct marketing in favor of its present independent jobber setup, Willisch was named special sales representative out of Milwaukee.

A native of Chicago, Willisch attended high school and DePaul university there and then went to the Walton School of Accounting.

New Manager at Witte

The appointment of Kjell O. Nilsson as general manager of the Witte Engine Works of United States Steel's Oil Well Supply Division at Kansas City, Missouri, has been announced by Fred F. Murray, president of the division.

Witte Engine Works designs and manufactures diesel, gasoline and gas engines for oil country, general industrial and farm use. The plant was one of the country's pioneer producers of internal combustion engines.

A native of New York, Mr. Nilsson entered the employ of Oil Well in 1952 as assistant to the works manager. Prior to his employment by U. S. Steel he was associated with American Bosch Corporation in the factory and sales divisions.

Mr. Nilsson received his primary education in the schools of Madison, New Jersey and his degree in Mechanical Engineering at Stevens Institute of Technology, Hoboken, New Jersey.

Mr. Nilsson will be assisted in his new responsibility by D. M. Hochswender, manufacturing manager; Dr. F. J. Kogel, chief engineer; M. E. Nicklin, sales manager, and L. A. Tilman, auditor.

API Announces New Committees

Appointment of eight functional committees for 1954 has been announced by R. M. Bartlett, vice president for the Division of Marketing of the American Petroleum Institute.

The committees and their chairmen are as follows:

Lubrication Committee—R. Cubicciotti, chairman, L. Sonneborn Sons, Inc., New York; P. W. Zumbrook, vice chairman, Sinclair Refining Co., New York.

Jobber Advisory Committee—John Harper, chairman, Harper Oil Co., Long Island City, N.Y.; Jess Knowles, vice chairman, Skelly Oil Co., Kansas City, Mo.

Service Station Advisory Committee—Charles Z. Hardwick, chairman, The Ohio Oil Co., Findlay, Ohio; A. M. Ogle, vice chairman, National Congress of Petroleum Retailers, Inc., Berkeley, Calif.

Fuel Oil Committee—J. L. Minner, chairman, Shell Oil Co., New York; L. B. Fox, vice chairman, Socony-Vacuum Oil Co., Inc., New York.

Marketing Personnel Training Committee—E. J. McClanahan, chairman, Standard Oil Co. of California, San Francisco, Calif.; L. T. White, vice chairman, Cities Service Petroleum, Inc., New York.

Marketing Research Committee—Nelson H. Seubert, chairman, Standard Oil Co. (New Jersey), New York; C. E. Skinner, vice chairman, Gulf Oil Corp., Pittsburgh, Pa.

Aviation Technical Service Committee—W. D. Parker, chairman, Phillips Petroleum Co., Bartlesville, Okla.; L. T. Rumsey, vice chairman, Standard Oil Company (Ohio), Cleveland, Ohio.

Weights and Measures Committee—L. L. Kennedy, chairman, Esso Standard Oil Co., Elizabeth, N. J.; W. K. McCoy, vice chairman, Gulf Oil Corp., Pittsburgh, Pa.

Esso Moves Mangelsdorf And Leet

Harold G. Mangelsdorf has been named general manager of Esso Standard's Manufacturing Department.

In his new assignment, Mr. Mangelsdorf succeeds William Naden in a move designed to permit Mr. Naden's concentrating on his broader functions as vice-president and as a primary contact director of the company.

Charles Leet, who was manager of the Bayonne Refinery, has been named to succeed Mr. Mangelsdorf as general manager of the Manufacturing Department's East Coast Division. With headquarters at Bayway Refinery, the East Coast Division heads the activities of Esso's five refineries along the East Coast, as well as the Pittsburgh Grease Works.

At Bayonne, the position which Mr. Leet has occupied will not be filled at this time. Willard F. Wadt will be in charge of Bayonne Refinery in his capacity as general superintendent.

Mr. Mangelsdorf is a 1930 graduate of Kansas State College, where he attained a B. S. degree in electrical engineering. He got a master's degree in fuel and gas engineering at the Massachusetts Institute of Technology two years later, and joined the company at Baton Rouge in 1934 as a combustion engineer. He was assistant manager of that plant when he moved to Bayway in 1950 to become general superintendent. He had served in his East Coast post for the past year.

Mr. Naden specialized in chemistry at the Lowell Textile School. Employed as a chemist at Everett Refinery in 1947, a series of promotions brought him to the post of general superintendent of that plan in 1934. Transferring to Baltimore Refinery in 1943, he supervised construction during that refinery's extensive modernization program.

During the war, he served in the Petroleum Administration for War as director of refining for District No. 1. In July, 1944, he was made head of Esso's Employee Relations Department. He was named a company director in 1946, became general manager of manufacturing in 1949, and vice-president the following year.

Mr. Leet moved into the newly-created post of manager at Bayonne Refinery last February, transferring from Baton Rouge Refinery. A 1930 graduate of West Virginia University with a B. S. degree in chemical engineering, he joined the company that year at Bayway as a student engineer. He went to Baton Rouge the following year as a chemical engineer. He became head of the Process Engineering Department in 1939, head of the Technical Division in 1946, and assistant general manager of Louisiana manufacturing in 1950, the post he held when he transferred to Bayonne last February.

McOmie and Merkus Assume New Duties at Shell

R. W. McOmie

P. J. Merkus

R. W. McOmie, manager of Shell Oil Company's Wilmington, California, refinery, has been appointed manager of the new refinery the firm is constructing at Anacortes, Washington, it has been announced by F. S. Clulow, vice president in charge of manufacturing.

P. J. Merkus, assistant to the vice president in charge of manufacturing, will succeed McOmie as manager of the Wilmington refinery.

While the refinery at Anacortes is being constructed, McOmie will devote his full time to coordinating various activities in connection with the project, and developing and training of the operating organization.

Mr. McOmie, a native of Sugar, Idaho, received a degree in chemistry from Stanford University, California, and started his Shell career in 1927 as a chemist at the company's Martinez, California, refinery. He progressed through increasingly responsible assignments at Martinez and Wilmington. In 1943 he was named assistant refinery manager at Wilmington and was promoted to manager in 1946.

Mr. Merkus received a Ph. D. degree in chemical engineering from the University of Michigan, Ann Arbor, and joined Shell in 1934 as a technologist at St. Louis. He became chief technologist at the company's Norco, Louisiana, refinery in 1939, manager of the Research and Development department at New York in 1943, and assistant to the manufacturing vice president in 1946.

Joseph P. Spang, Jr. Elected Director of United States Steel

Benjamin F. Fairless, chairman of the board of directors of United States Steel Corporation, has announced the election of Joseph P. Spang, Jr. of Boston, Massachusetts to that board, succeeding the late Nathan L. Miller.

Mr. Spang is president of the Gillette Company. He was born in Boston, Massachusetts, the son of Joseph Peter and Anna Bosse Spang, and attended Harvard University from which he graduated in 1915.

Mr. Spang joined Swift and Company in 1915 occupying various positions prior to his appointment as vice president in charge of sales in 1930. In 1938 he became associated with and was elected president of Gillette Safety Razor Company.

Mr. Spang is also a director of the First National Bank of Boston.

J. Reinsma, Stewart-Warner Corporation

John J. Gleeson, Plymouth Div., Chrysler Motors

California Research's J. M. Stokely

Apologies to Mr. Reinsma, Mr. Gleeson and Mr. Stokely

Your *Spokesman* blushes to tell its readers of an obvious error resulting from a picture mix-up appearing in the January issue. On page 16 we erroneously pictured Mr. Gleeson as Mr. Reinsma and on page 20 Mr. Reinsma as Mr. Stokely, on page 8 Mr. Stokely as Mr. Gleeson. If this explanation has completely confused you, look at the top of the page and you will see all pictures correctly identified.

The entire Symposium complete with correct pictures will be available in reprint form following the March issue, which will contain stenographic notes of comments made during and following the papers you read in the January issue.

Industry NEWS

ASTM Standards on Petroleum And Petroleum Products

The November 1953 edition of this compilation includes in their latest form, most of the ASTM specifications, test methods, and definitions widely used in this field. (The tests for knock rating of engine fuels and certain standards for measuring and sampling are issued in special manuals and not included in this compilation.)

Prepared by ASTM Committee D-2 on Petroleum Products and Lubricants, this edition provides in a convenient manner 146 ASTM standards, including 130 test methods; 10 specifications; one classification of diesel fuels oils; three definitions of terms relating to petroleum, specific gravity, and rheological properties of matter; two recommended practices: one for the purchase of uninhibited mineral oil for use in transformers and in oil circuit breakers; one for designating significant places in specified limiting values; and other material.

Groups of standards cover broad classifications of petroleum products: crude petroleum; butadiene; motor and aviation fuels; petroleum solvents and naphthas; diesel fuels; distillate burner fuels, kerosene and illuminating oils; lubricating oils; turbine oils; electrical insulating oils; plant spray oils and petroleum sulfonates; lubricating greases and petrolatums and paraffin waxes. Included also are standard specifications for ASTM thermometers and ASTM hydrometers, and test method standardization of etched-stem liquid-in-glass thermometers.

New tentative methods of test are included for: effect of grease on copper lead in new and used greases; leakage tendencies of automotive wheel bearing greases; water washout characteristics of lubricating greases; sampling liquefied petroleum gases; sulfur in petroleum products and liquefied petroleum gases by the CO_2-O_2 lamp method; vapor pressure of liquefied petroleum gases; unsaturated light hydrocarbons (silver-mercuric nitrate method); polarographic determination of tetraethyllead in gasoline; API gravity of petroleum and its products (hydrometer method); and specific gravity of petroleum and its products (hydrometer method).

New appendices cover, in addition to report of Committee D-2 on Petroleum Products and Lubricants, proposed methods of test for: functional life of ball bearing greases; chlorine in lubricating oil; sodium in residual fuel oil by flame photometer; weathering test for liquefied petroleum gases; analysis of graphite under consideration by Research Division XII on graphite tests—other items cover recommended practices for applying precision data given in ASTM methods of test for petroleum products and lubricants; and proposed changes in the "ASTM Manual of Engine Test Methods for Rating Fuels" (1952 Edition) for the elimination of the bouncing pin.

A high percentage of the material included in the earlier edition has been revised and 11 of the methods are new. The specifications and tests that have been revised contain a brief explanation in footnotes form of changes incorporated since the previous edition. A new section has been added giving a summary of changes made in ASTM standards on petroleum products and lubricants in 1953.

An easily usable Table of Contents is included (by subject and ASTM serial designation) and an extensive index.

Copies of this widely-used 916-page book, in heavy paper cover, can be obtained from Headquarters of the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., at $6.00 each.

British Industries Fair Scheduled for May

The British Industries Fair, Britain's annual show window of new trade products, will be held this year in London and Birmingham from May 3 to 14.

Two thousand exhibitors representing nearly 100 different industries will demonstrate to home and overseas buyers a cross section of British production from confectionery to concrete mixers. Consumer goods will be shown at two halls in London—Olympia and Earls Court—while heavy industry will appear at the giant exhibition hall at Castle Bromwich, Birmingham.

The heavy industry section will again cover the greatest area. Among consumer goods, the Boat and Small Craft Section, an innovation in 1953, will more than double last year's size. Gifts and Decorative Accessories will occupy its biggest space since 1948. Musical Instruments will have the greatest display of pianos since the war; Scientific and Optical Instruments will have a large section, as will Paper and Stationery.

The future of the B.I.F. as an annual event has been assured by the recommendations of a recent committee of inquiry, and plans are under way for welcoming the thousands of overseas buyers who are expected to attend in 1954. (Last year 996 U. S. buyers attended.) Advance catalogs with exhibitors' names, addresses, and products will be available to U. S. business men in advance of the Fair. Prospective visitors are invited to ask the nearest British Consulate for a free copy, indicating whether they need the London or Birmingham edition, or both.

Winter Meeting of SSCI Held in New York City

The winter meeting of the Steel Shipping Container Institute, Inc. was held in New York in January with committee meetings at the Hotel Pierre and the board of directors and members meetings at the Hampshire House.

Most members of the industry feel that volume for the first quarter will compare favorably with the fourth quarter of 1953. Some members predict that the latter half of the quarter may show a small increase. Indications are that the increasing demand for small packages and lined containers will continue throughout the year.

All members agree that inventories in the hands of purchasers are at the lowest ebb in many years. Similar reports concerning inventories seem applicable to most Government agencies, from whom inquiries in fairly large volume are expected soon.

Both the board of directors and members meetings were concerned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When you specify J&L Steel Drums and Pails you are assured of maximum protection for your product. In terms of "steady action" you can depend upon J&L because:
1 J&L Drums and Pails are made from high quality J&L Steel Plate.
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You can obtain J&L Steel Drums and Pails through plants located in leading industrial centers. You'll find J&L service fast and efficient. Call the J&L office serving your community.
The J&L line includes all types of Closures and Finishes. Bright, colorful decorations may be reproduced to your specifications. Heavy-duty ICC Drums. Light-gauge Drums. 55, 30 and 15 gal. capacity and 100-lb. Grease Drums. Lightweight Drums for Chemical and Powdered Materials. 1-10 gal. capacity Steel Pails for Foods, Chemicals, Oils.
J&L STEEL
Jones & Laughlin
STEEL CORPORATION — Pittsburgh
CONTAINER DIVISION
405 Lexington Ave., New York 17, New York

with the continued research for improved lined containers and improved methods of construction and the feeling was expressed that completely new packages may be developed during the current year, particularly in the heavy drum classification.

Progress and future direction of cooperative programs with the Manufacturing Chemists' Association and the Petroleum Packaging Committee, as well as ways and means of better serving the food and paint, varnish and lacquer industries, were discussed.

The following members of the Petroleum Packaging Committee, Packaging Institute, were guests of the Institute: A. Douglas Murphy, F. W. Langner, H. M. Hisor, C. H. Phillips, S. S. Simon and H. M. Wogisch.

Archer-Daniels-Midland Announces New Bulletin

In a new bulletin, the Chemical Products Division of Archer-Daniels-Midland Company, Cleveland, Ohio, has published technical information on its complete line of fatty alcohols.

The bulletin covers the chemical structure and composition, reactions, applications, and solubility data on the company's standard ADOLS, as well as a line of new ADOLS and UNADOLS which recently have been introduced in pilot plant quantities for research and development. Since these new alcohols described in the ADM bulletin have never before been available, unlimited possibilities exist for their application.

In writing for copy, request Technical Bulletin No. 903-A.

Petroleum Educational Institute Issues New Publication

The Petroleum Educational Institute has just announced its new *PEI Journal* which will be issued six or more times during the following year and is published to cover the fundamentals of new and changing developments in connection with products information. The publication is directed primarily to sales and service personnel who will find it useful in their daily work. All technical information is presented in layman's language and illustrated in such a manner that it is clearly understood by those who do not possess a technical background.

In addition to products information, it will also give current developments in both petroleum and allied industries of general interest and help the sales and service personnel.

Contents of the first issue will cover:

- New Oil Drain Recommendations—13 pages, 47 illustrations
- When to Drain—10 pages, 96 illustrations
- Fretting Corrosion—5 pages, 26 illustrations
- Why 12 Volts?—6 pages, 33 illustrations
- API service classifications—14 pages, 60 illustrations
- Miscellaneous Short Subjects – 6 pages, 15 illustrations
- Thoughts to Sales Personnel – 3 pages, 49 illustrations

In addition to the above, there will be a cross index of over 3,300 entries covering this issue of the *Journal* and the 25 Home Study Assignments in the Fundamentals and Application of Fuels and Lubricants. This index, plus the indexes of subsequent issues, will comprise the master index for Volume 1. The first issue will comprise a total of 84 pages with 304 illustrations.

For additional information regarding this publication, address your inquiries to Petroleum Educational Institute, 9020 Melrose Avenue, Los Angeles 46, California.

Socony-Vacuum Increases Research Fellowships

To help meet the higher cost of graduate education, Socony-Vacuum Oil Company, Inc., will increase the value of its research fellowships from \$2,000 to a maximum of \$3,000 each in the school year 1954-55.

The current program usually grants \$500 to schools and \$1,500 to recipients, whether married or single. Under the new plan, schools will normally receive \$750, while married men will get \$2,250 and single men \$1,750.

The company and its affiliates are maintaining fellowships for the 1953-54 academic year at the following institutions:

Socony-Vacuum Oil Company—Brooklyn Polytechnic Institute, Brown, Colorado, Colorado School of Mines, Columbia, Georgia Tech, Harvard, Illinois, Johns Hopkins, Lehigh, Michigan, Notre Dame, Ohio State, Pennsylvania, Wisconsin, Yale.

General Petroleum Corporation—California Institute of Technology, Southern California.

Magnolia Petroleum Company—Louisiana State, Rice Institute, Texas, Texas A&M, Tulane.

"The Texas Story" Told by Marquis James

Out of hundreds of oil companies who trace their origin to the historic "Spindletop" gusher which blew in at Beaumont, Texas in 1901, only two survived and are a factor in the oil industry today.

The colorful story of one of these survivors, The Texas Company, is traced in a new book by Marquis James, Pulitzer prize-winning biographer.

Entitled "The Texaco Story—The First Fifty Years," Mr. James' brief and readable book records the early struggles as well as the later successes which lead The Texas Company to its present role as one of the leading American oil companies.

Many of the names which figure prominently in "The Texaco Story" are well-known in the petroleum industry and business and financial circles throughout the world. Among them are Joseph S. "Buckskin Joe" Cullinan, John W. "Bet-a-Million" Gates and Arnold Schlaet, all of whom were great names in the early days after the Spindletop discovery changed the course of the oil business in the United States. In more modern times, the names of W. S. S. Rodgers and Harry T. Klein, recently retired as Chairman of the Board and Chairman of the Executive Committee, respectively, of The Texas Company, figure prominently in the story.

Emery Announces New Fatty Acids

Emery Industries, Inc., announces the commercial availability of three new, low-cost, structurally modified fatty acids. Said to be unlike anything previously available, these acids possess the color and heat stability associated with high-quality stearic and palmitic acids yet have the consistency and solubility characteristic of distilled tallow fatty acids. These differences are significant since two of these acids are practically saturated (2 to 4 I.V.) C_{16} and C_{18} monocarboxylic acids.

The manufacturer claims the unique character of these acids is illustrated by the solubilities of their potassium soaps. At 16% real soap concentrations at room temperature, solutions are clear and completely fluid.

In hydrocarbon systems, the aluminum soaps of these acids possess outstanding gelling properties. Worked

stability of lubricating greases made from the aluminum soaps of these new products is comparable to that of commercial high-gel stearates.

For further information or samples, contact Emery Industries, Inc., Development & Service Dept., Carew Tower, Cincinnati 14, Ohio.

Socony-Vacuum Successful On Three New Wells

Socony-Vacuum Oil Company, Inc., has announced successful tests on two indicated Western Canadian oil discoveries in which it has a half interest. The company also announced a successful confirmation-test well half a mile from an earlier discovery, in which it also has a half interest.

The three new producing wells are all in the same 98,880-acre Crown reservation in which Socony-Vacuum, drilling on a farm-out from Seaboard Oil Company and associates, brought in two wildcat wells as producers earlier this year. Socony-Vacuum has now brought in four discovery wells out of five wildcats it has drilled in this block, and the one confirmation-test well.

The Socony-Seaboard Pembina No. 1, first of the four successful wildcats, was drilled last June, 65 miles southwest of Edmonton, Alberta. The second, North Pembina No. 11-13, 60 miles west of Edmonton and 25 miles south of the Trans Mountain Pipe Line, found oil in October.

The confirmation-test well just announced is half a mile south of Pembina No. 1, the reference point. In 45 minutes of testing from 5332 to 5343 feet, this well recovered 2070 feet of clean oil.

Of the two new discoveries, Pembina No. 12-12 is three miles east and a little south of Pembina No. 1. In one hour of testing between 5078 and 5095 feet, this well recovered 3270 feet of clean oil.

The other of the newest discoveries is Violet Grove No. 30-2 four miles east and two miles north of Pembina No. 1. In a test from 4853 to 4973 feet, this well recovered 440 feet of oil and 200 feet of oil-and-gas-cut mud.

All three new wells found oil in the Cardium sand, of Cretaceous age, and all are still drilling and testing. The oil in each well, as in the two earlier discoveries in this block—also in Cardium sand—is around 37 gravity.

Controllers Urged to Plan Now for Future Electronics

Financial executives should draw up a "blueprint" now for doing accounting and other office work by electronic machines, even though the plan might not be economical for immediate use, according to J. W. Haslett, manager of the methods and statistics department of Shell Oil Company.

The blueprint should be available for the time when the company finds it desirable to set up central locations where paper work will be processed electronically, he said.

"The blueprint assumes the scrapping of preconceived notions on the part of controllers and should not emphasize the present cost of machines," Haslett continued, "since their cost eventually may be less than today.

"Even if the blueprint is tucked away in your top desk drawer there may come a time when you are glad you have it ready. Central data processing offices may come sooner than we think. With continued industrial growth small companies are becoming larger and what looks impractical today may be just the answer tomorrow.

"Nor should the controller feel that research of this kind compromises his well earned reputation for conservatism. Dynamic controllership sometimes consists of dipping into the dream pot. Don't we all engage in this unscientific method in some of our regular financial forecasts? The blueprint is no more than insurance against a future unknown."

Some managements which are undecided whether expensive electronic computers are justified, he said, will have to reconsider the policy of decentralizing paper work in branch offices. To gain the benefit to be obtained from processing large volumes of transactions in one place it may be necessary, he indicated, for paper work to be brought into central "data processing offices."

The preparation of the blueprint was one of the phases of a "down-to-earth" management program by which the controllers of companies, regardless of size, were told they could determine the utility in their companies of electronic computing machines which are on the market today.

Merger Announced

The merger of The Parkersburg Rig and Reel Company and Aetna Ball & Roller Bearing Company, Chicago, was effective Feb. 1 and the combined operation formally took Parkersburg-Aetna Corporation as its new name.

The business of the two concerns will be conducted as divisions of the West Virginia corporation. Parkersburg Rig and Reel, established in 1897, manufactures equipment used in the production, processing and storage of petroleum products. Aetna manufactures ball and roller bearings and related products.

Oil Industry Will Not Decline With Rise of Atomic Energy, Says William M. Holaday

The rise of atomic energy will not spell the decline of the oil industry, according to William M. Holaday, director of laboratories for Socony-Vacuum Oil Company, Inc.

In an article in the current issue of *The Flying Red Horse*, the company's employee-stockholder publication, Mr. Holaday says the oil industry already is making good use of atomic by-products to improve its own products. Atomic energy as fuel for electrical power plants will have a rough time competing with conventional oil and coal, he says, and the atomic-powered automobile "is a far-fetched idea."

The article points out that "it is hard to imagine a car with five feet of concrete around its engine" to shield passengers from lethal radiation. "And how are you going to service an atomic engine? Will the mechanics stand behind concrete walls and work on the engine with long steel tongs?" The oil company executive also warns that "if an atomic-engined car were in a collision, deadly radiations might escape from the engine and contaminate a large area." The same hazard would apply to atom-powered planes, he says.

Mr. Holaday disclosed that his company is operating an atom smasher at its Field Research Laboratories near Dallas, Tex., which he believes is the only atom smasher in the oil industry.

"With the neutrons provided by our atom smasher and with radioactive materials purchased from the government's plant at Oak Ridge," he says, "we are working out some remarkable ways to use the atom."

Radioactive materials have been used to trace the progress of oil through pipe lines, the path of catalysts in refining. Now, Mr. Holaday says, "tracers help us discover just how oil, gas, and water flow in the ground, and at what rates of flow we get the most oil out. They help tell us what sort of rock we are drilling through and how porous it is."

At the moment, he says, researchers at the company's Paulsboro, N. J., laboratories are also working with the Atomic Energy Commission on an atomic test for harmful metals in crude oil. They can detect one part of arsenic in a billion parts of crude oil.

Mr. Holaday believes "it will be at least 15 years before the first commercial atomic power plant to generate electricity will be in operation. That does not mean that such plants will not be built sooner. But it will take time to solve the problems of economical construction and operation."

He says authoritative estimates indicate that a power plant would cost from \$370 to \$600 for every kilowatt of electricity it would produce, whereas conventional plants cost from \$100 to \$200 a kilowatt. Nuclear power, the article states, can never compete with hydroelectric power for the simple reason that water comes free and uranium does not. Coal, oil, and gas will give nuclear power rough competition for decades to come except in isolated areas far from the oil and coal fields. In Labrador where new iron deposits are being worked, a nuclear power plant might be highly economical compared to the cost of hauling other fuel to the plant."

Despite all the problems, Mr. Holaday says, "don't for one minute underestimate the American businessman and researcher. They thrive on doing the impossible. When the government decides that atomic 'secrets'—and with the Russians setting off hydrogen bombs, there would seem to be few atomic secrets left—should be turned over to private industry, we may see some amazing advances. With private industries all over America using the atom to make better mousetraps, nothing is impossible."

Rocky Mountain Geologists Feature Oil Frontiers

More than 1600 geologists of the nation will gather at Albuquerque, N. M., for the fourth annual meeting of the Rocky Mountain Section, American Association of Petroleum Geologists next February 22nd. The theme, "Exploration Frontiers of the Rocky Mountain Region" will be developed through addresses by prominent geologists of the Rocky Mountains during the three-day meetings.

Two keynote speeches will emphasize the importance of oil in this region. Max L. Krueger, geologic consultant of Laramie, Wyo., will speak on geologic aspects of the region with Robert O. Anderson, president of Malco Refineries, Inc., Roswell, N. M., discussing economics of the industry in the region.

Paul H. Umbach, Denver oil consultant and president of the group, will review history of the section, which started as an outgrowth of the vastly expanded oil industry in the region during the past several years and has expanded into one of the largest such groups in the nation.

Each geologic province of the region, extending from northern New Mexico into the Canadian Rockies, will be reviewed and discussed at this meeting. "With this region becoming one of the most important from a future oil reserve standpoint in the nation, emphasis will be directed toward these new frontiers," said Phil D. Helmig, convention chairman.

Special entertainment and activities are planned for wives of those attending and an unusual feature of the convention will be Exhibits Day, where the most modern and up-to-date equipment for the oil industry will be on display for the geologists.

Shell Chemical Forms New Ammonia Division

Shell Chemical Corporation has formed an ammonia division to handle the manufacture, distribution and sale of this chemical vital to agriculture and industry, it has been announced by R. C. McCurdy, president.

Headquarters of the new division are San Francisco. Its formation followed the opening of the new Shell Chemical ammonia plant at Ventura, California.

G. R. Monkhouse, vice-president of the company, has been appointed to head the new division. L. M. Roberts, general manager of manufacturing in the company's New York headquarters, will go to San Francisco as the new division's operations manager in charge of manufacturing, distribution, and marketing engineering. In this position, he will have direct charge of the company's two ammonia plants—the pioneer plant, at Pittsburg, California, which has been operating since 1931 and the recently opened plant at Ventura. V. C. Irvine has been designated sales manager of the ammonia division.

In addition to their new duties in the ammonia division, Monkhouse and Irvine will continue as manager and sales manager, respectively, of Shell Chemical's western division which handles sales of all other Shell chemical products.

Anhydrous ammonia has started flowing from a new plant opened at Ventura, California in December. The plant cost approximately $10,000,000.

Mr. McCurdy said the plant typifies the important contribution made by the chemical industry to the great expansion in America's economy. He noted that the ammonia manufactured at the plant will be used largely as a fertilizer to help support the country's rapidly-growing population by making possible greater food production.

The plant will have a productive capacity of 150 tons a day. Together with Shell Chemical's ammonia plant at Pittsburg, California, it maintains Shell's position as the largest producer of anhydrous ammonia and ammonium sulphate west of the Rockies.

The bulk of Shell's ammonia production is earmarked for western agriculture, whose use of ammonia has increased remarkably in recent years. In 1942, the Rocky Mountain and Pacific Coast states used a total of 382,266 tons of fertilizer; in 1952, the farmers of California alone used 750,000 tons.

The 27-acre plant site three miles north of downtown Ventura was chosen because of the rapidly growing demand for ammonia fertilizer in California and Arizona and because the Shell Oil Company's operations in the Ventura oil field offer an ample supply of natural gas needed in the manufacturing process without interference with other industrial and domestic uses.

Frank D. Kuenzly, formerly superintendent of the Pittsburg plant, will be manager of the new plant where about 140 persons will be employed. A native of Colfax, California, Mr. Kuenzly received a degree in chemistry from the University of California at Berkeley. He joined Shell at Pittsburg in 1934 and has served also at San Francisco and Dominguez, California, and at Dumas and Houston, Texas.

Ammonia's most important application is as a fertilizer, McCurdy said, because the chemical contains 82 per cent nitrogen, the growth element most needed by plants. Agricultural experts have noted that the increasing food needs in the United States will have to be met by increased production on the land already available. This will require much greater use of fertilizer and ammonia is recognized as the best method of supplying soil with nitrogen. Experts estimate that for each dollar spent on nitrogen fertilizer from two to ten dollars normally are returned in increased crop value.

The Ventura plant will also produce ammonia for use in industry for refrigeration, and the manufacture of synthetic fibres, explosives, pulp and nitric acid.

Shell Pipe Line Corporation Establishes Denver Division

The establishment of a Denver division for Shell Pipe Line Corporation with headquarters in that city, has been announced by T. E. Swigart, president.

The new division office, which opened in December, assumed operation of the company's gathering systems in the Denver-Julesburg Basin, and will handle future pipe line developments by the company in the Rocky Mountain area and the Williston Basin. Division superintendent is Roy Belshe, who transferred from Wichita, Kansas.

Division personnel are located in Denver's new Shell building, now under construction, which is also to be headquarters for Shell Oil Company's recently established Denver exploration and production area.

Continental Can Gets Court Order

Continental Can Company has obtained a court order temporarily suspending the compensatory rental provision of the 1950 court decree that would have necessitated increases of over 75 per cent in the 1954 rates canners would pay for renting container closing machines.

The order, handed down by Judge George B. Harris of the Federal District Court, San Francisco, suspends for one year the provision of the 1950 decree that required all such rental and service charges to cover, completely, the costs of leasing, servicing, depreciation, insurance and return on investment after January 1, 1954.

Seeking modification of this judgment, Continental's motion was based on the fact that closing machine rentals were reaching such unreasonable levels that canners were being forced to purchase the equipment, even when they were unwilling or financially unable to do so.

This fact was brought out in testimony before the court by Peter P. Wojtul, Continental's vice-president in charge of sales.

Mr. Wojtul also testified that some canners had said they did not desire to buy the necessary machinery because they feared such purchases would tie up too much capital in equipment that might be obsolete in a few years.

Du Pont Bulletin Revision

A third revision of a Du Pont technical bulletin on "Teflon" tetrafluoroethylene resin finishes is now available.

The twelve-page bulletin lists seventeen successful new "Teflon" applications in addition to those reported in the earlier edition published in March 1953. They are: agitator paddles, barrattes, dry ice platens, dye vats, filling equipment, floor tile molds, glass stop cocks, glue pots and dispensers, glueing machines, ladles, mandrels, pails, reels, rubber boot lasts, size boxes, soap dies, and troughs.

The bulletin may be obtained by writing Du Pont Finishes Division, Room D-7145, Wilmington 98, Delaware.

FUTURE MEETINGS of the Industry

FEBRUARY, 1954

17-18 Iowa Independent Oil Jobbers Assn., Fort Des Moines Hotel, Des Moines, Iowa.

22-24 National Tank Truck Carriers (top management conference), Palmer House, Chicago, Ill.

23-24 Packaging Institute (petroleum packaging committee), Houston, Texas.

24-25 Wisconsin Petroleum Assn., Schroeder Hotel, Milwaukee, Wis.

MARCH, 1954

1-5 American Society for Testing Materials (spring meeting), Shoreham Hotel, Washington, D. C.

2-4 Society of Automotive Engineers (national passenger car, body, and materials meeting), Hotel Statler, Detroit, Michigan.

3-5 American Petroleum Institute (Division of Production, Southwestern District), Rice Hotel, Houston, Tex.

8-10 American Inst. of Chemical Engineers, Statler Hotel, Washington, D. C.

8-10 Texas Oil Jobbers Assn. (annual convention exhibit), Baker Hotel, Dallas, Texas.

8-10 Oil Industry Information Committee, Shamrock Hotel, Houston, Texas.

16-18 Ohio Petroleum Marketers Assn. (annual convention and marketing exposition), Deshler-Hilton Hotel, Columbus, Ohio.

17-19 American Petroleum Institute (Division of Production, Mid-Continent District), Skirvin Hotel, Oklahoma City, Okla.

17-18-19 American Petroleum Institute (Division of Production, Mid-Continent District), Biltmore Hotel, Oklahoma City, Okla.

24 to April 1 American Chemical So-Society, Kansas City, Mo.

29-31 Western Petroleum Refiners Assn., Plaza Hotel, San Antonio, Texas.

APRIL, 1954

5-7 American Society of Lubrication Engineers (Annual Meeting and Exhibit), Netherland Plaza Hotel, Cincinnati, Ohio.

8-9 American Petroleum Institute (division of production, Rocky Mountain district), Townsend Hotel, Casper, Wyo.

12-15 Society of Automotive Engineers (national aeronautical meeting, aircraft engineering display, and aircraft production forum), Hotel Statler, New York, N. Y.

14-16 National Petroleum Assn. (51st semi-annual meeting), Cleveland Hotel, Cleveland, Ohio.

MAY, 1954

2-4 Independent Petroleum Assn. of America (midyear meeting), Cosmopolitan Hotel, Denver, Colo.

3-5 American Petroleum Institute (Lubrication Committee), Skytop Lodge, Skytop, Pa.

3-7 American Petroleum Institute (safety & fire protection committees, midyear meeting), Chase-Park Plaza, St. Louis, Mo.

6-7 American Petroleum Institute (division of production, Pacific Coast district), Statler Hotel, Los Angeles, Calif.

6-8 National Tank Truck Carriers (6th annual convention), Netherland Plaza, Cincinnati, Ohio.

9-11 Empire State Petroleum Assn., Roosevelt Hotel, New York, N. Y.

10-12 American Petroleum Institute (Division of Transportation, Products Pipe Line Conference), Warwick Hotel, Philadelphia, Pa.

10-13 American Petroleum Institute (Division of Refining, Midyear Meeting), Rice Hotel Houston, Texas.

16-19 American Inst. of Chemical Engineers, Springfield, Mass.

17-19 American Petroleum Institute (Division of Marketing, Midyear Meeting), Cosmopolitan Hotel, Denver, Colo.

24-25 Packaging Institute (petroleum packaging committee), Cleveland, Ohio.

31-June 5 American Petroleum Institute (division of production, midyear committee conference), San Francisco, Calif.

JUNE, 1954

3-4 Pennsylvania Grade Crude Oil Assn., William Penn Hotel, Pittsburgh, Pa.

6-11 Society of Automotive Engineers (summer meeting), The Ambassador and Ritz-Carlton Hotels, Atlantic City, N. J.

13-18 American Society for Testing Materials (annual meeting and exhibits), Sherman Hotel, Chicago, Ill.

17-19 American Petroleum Institute (Division of Production, Eastern District), Greenbrier Hotel, White Sulphur Springs, W. Va.

21-25 American Inst. of Electrical Engineers (combined summer and Pacific general meeting), San Francisco, Calif.

AUGUST, 1954

16-18 Society of Automotive Engineers (national West Coast meeting), Los Angeles, Calif.

SEPTEMBER, 1954

12-16 Society of Automotive Engineers (national tractor meeting), Schroeder Hotel, Milwaukee, Wis.

12-16 American Inst. of Chemical Engineers, Colorado Hotel, Glenwood Springs, Colo.

12-17 American Chemical Society, New York, N. Y.

13-14 Packaging Institute (petroleum packaging committee), Philadelphia, Pa.

15-17 National Petroleum Assn. (52nd annual meeting), Traymore Hotel, Atlantic City, N. J.

OCTOBER, 1954

4-9 Society of Automotive Engineers (national aeronautic meeting), aircraft engineering dis-

play, and aircraft production forum, Hotel Statler, Los Angeles, Calif.

10-12 National Assn. of Oil Equipment Jobbers (4th annual meeting), Congress Hotel, Chicago, Ill.

Week of Oct. 18 Society of Automotive Engineers (national transportation meeting), Boston, Mass.

20-21 Nebraska Petroleum Marketers Assn. (annual convention), Paxton Hotel, Omaha, Neb.

23-25 National Association of Oil Equipment Jobbers (annual meeting), Hotel President, Kansas City, Mo.

25-26 Independent Petroleum Assn. of America (annual meeting), Tulsa, Okla.

25-27 NLGI ANNUAL MEETING, MARK HOPKINS HOTEL, SAN FRANCISCO, CALIF.

25-29 American Institute of Electrical Engineers (fall general meeting), Chicago, Ill.

26-27 Society of Automotive Engineers, national diesel engine meeting, Hotel Statler, Cleveland, Ohio.

NOVEMBER, 1954

1-2 Independent Petroleum Assn. of America (annual meeting), Shamrock Hotel, Houston, Texas.

4-5 Society of Automotive Engineers (national fuels and lubricants meeting), Mayo Hotel, Tulsa, Okla.

8-11 American Petroleum Institute (34th annual meeting), Conrad Hilton Hotel and Palmer House, Chicago, Ill.

28 to Dec. 3 American Socy. of Mechanical Engineers, Statler Hotel, New York, N. Y.

29-30 Packaging Institute (Petroleum Packaging Committee), New York, N. Y.

DECEMBER, 1954

12-15 American Inst. of Chemical Engineers (annual meeting), Statler Hotel, New York, N. Y.

phase 4:

Foote's new lithium chemical plant

PLAN AHEAD

The end of construction and the beginning of full production are near at hand. Quantities of lithium hydroxide are now being shipped from Foote's new lithium chemical plant at Sunbright, Va.

With the realization that Sunbright is approaching full production, you can now plan ahead in terms of Foote lithium.

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